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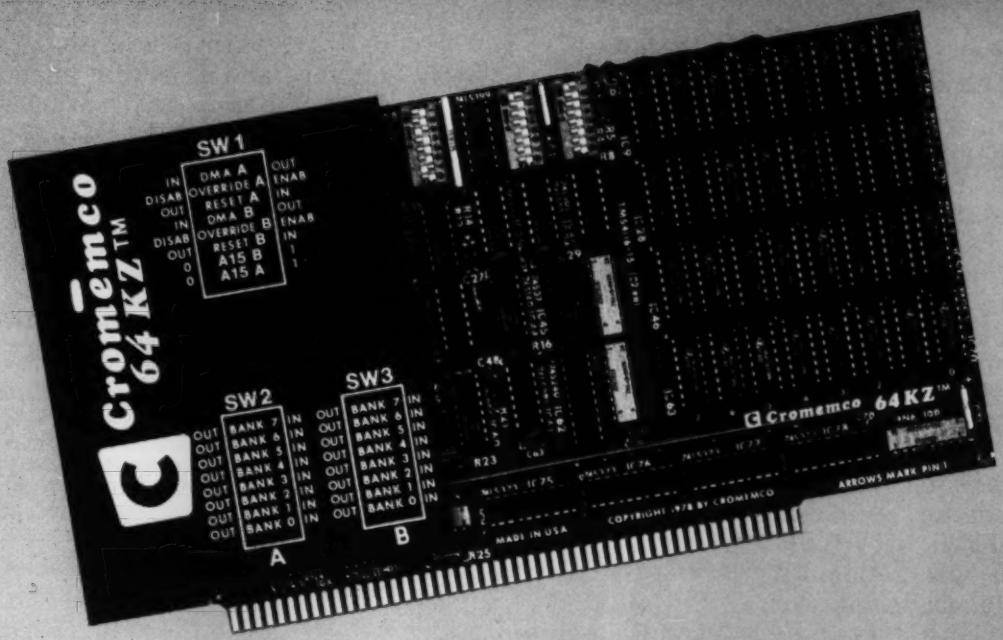

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The Cover

The cover is a reproduction of an acrylic painting by Ellen Steinfeld of Amherst, N.Y. Ellen's works have been shown in four solo exhibits and fourteen group exhibitions and she received the first prize in painting in the NY State Art Open in 1978.

The painting ties in with two ecology articles in this issue: "A Simulation of Pest Control," page 42 and "Niche: A Basic Game of Ecology," page 87.

July 1979
Volume 5, Number 7

Creative Computing magazine is published monthly by Creative Computing, P.O. Box789-M, Morristown, NJ 07960. (Editorial office: 51 Dumont Place, Morristown, NJ 07960 Phone: (201) 540-0445.)

Domestic Subscriptions: 12 issues, $15, 24 issues $28, 36 issues $40. Send subscription orders or change of address (P.O. Form 3575) to Creative computing, P.O. Box 789-M, Morristown, NJ 07960. Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription (to be charged only to a bank card).

Second class postage paid at Morristown, New Jersey and at additional mailing offices.

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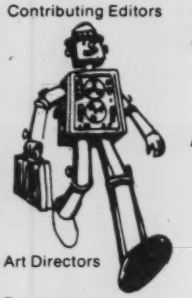

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Sample issue $2.00;
One-year subscription $15.00

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Editorial

David H. Ahl

Reinventing the Wheel

I never cease to be amazed at the way people insist on reinventing the wheel. Four recent incidents really pushed the point home; let me share them with you.

1. At the Trenton Computer Festival, a teacher from Ocean Township HS, John Best, gave me a nice set of computer graphics. He related that he had translated Mike Zorn's Super-Rose programs (in Basic for the PET. Creative, April 1979) into Fortran and produced the graphics. Ironically, although Mike Zorn wrote Super-Rose from scratch, it bears a more-than-passing resemblance to Lissajous (Creative, Sep/Oct 1977) which we printed in Basic for the first time, it having originally been written in Fortran!

In this instance, probably everybody involved benefitted from this reinvention of the wheel — or at least each one got some good experience writing or translating a program.

2. "Can you see any redeeming virtue in publishing this?" "No, said the little red hen." "Aaugh; not another one!" These were some of our editor's comments on just one day's worth of games submitted to Creative Computing containing yet another Blackjack, Star Trek, and Tic Tac Toe.

I was leafing through the book, "The Way to Play" (available from Creative Book Service — advt.) which contains the rules for several hundred card, board, and indoor games. I would guess that fewer than 5% have been programmed, yet budding programmers always seem to home in on the same over done group.

In this case, probably the programmers benefit from writing an overdone game, but no one else does because there's no new contribution to the published body of software.

3. I was looking over the huge 3-volume set of papers from the recent ADCIS conference. While there were some excellent papers, many of them were strikingly similar to papers the year before and the year before, etc. In fact, I dug out the Proceedings from the second CCUC Conference (1971) and found many conclusions and recommendations virtually identical to those from this conference (1979).

Delving deeper, I was struck that the references of many authors included mainly their own previous papers or those of the same organization or conference. Unfortunately, the educational computing field has been and is highly fragmented. Maybe the National Conference in Iowa this June will help, but given past trends, I'm not wildly optimistic.

In this third case, reinventing the wheel benefits practically no one, but worse, it means that progress is made much more slowly than it should be. Indeed, the criticism of some people that software and courseware is lagging behind hardware developments is quite valid. This is certainly one contributing factor.

4. One of the many hats I wear is a proposal reviewer for the National Science Foundation. Funding proposals are, of course, reviewed without knowing who was the originator. And it's a good thing!

I reviewed two proposals last week (asking for mega bucks!) which, for all intents and purposes, were carbon copies of projects completed in the late 1960's. In slightly different ways, both proposals put forth the idea that computer literacy should be taught in high school. Pardon my sarcasm if I say, "How novel!"

Yet from talking to scores of math teachers at the recent national NCTM Conference, it is apparent that, for all its virtue, computer literacy is not being taught to most students.

Should we reinvent the wheel yet again and prove that computer literacy is a "good thing"? Or can we simply get on with it?

In looking this over, I realize that I'm probably just as guilty as everyone else in reinventing the wheel. Back in 1972, I wrote an editorial for EDU called, "What's Wrong with the Little Red Schoolhouse" (reprinted in Best of Creative - Vol. 1) and I'm saying the same things now as I did then. Hopefully, if people agree with these notions and act on their knowledge, I won't have to write this again in seven years. Or is that an impossible dream? □

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In the recent tornado which wreaked unholy havoc on our city, many of us in the Wichita Valley TRS-80 Users Group lost our computers, our tape and disk library of software, and our library of computer books and periodicals. Even our club's own library of software and publications was destroyed.

We all have plans to replace our personal computers and software, but at this time I am particularly interested in trying to help our club replace its loss. Any club, publisher, software producer, or individual who wishes to do so, may contribute non-cash items, such as software, back issues of computer publications, and books on computers.

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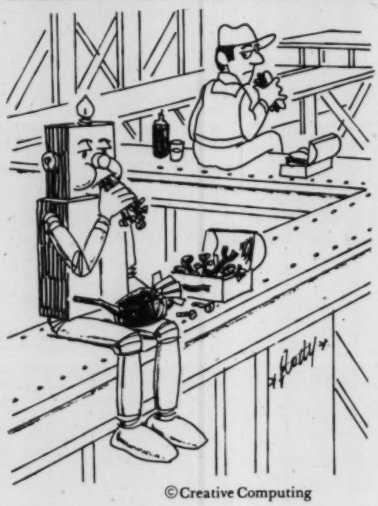

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Mayjune Mishaps

In Random Ramblings (May, page 24), we neglected to say that Cardinal is a distributor of Omar which is made by Tryom, Inc. Sorry.

And, Lee Felsenstein would like the following points to be made about the Majic Wand (June, page 60): "Bob did not say that cathode ray tubes would never have been developed if LEDs were available for mechanical scan TV...(And,) the current state of the Majic Wand is that it is the size of a ball point pen with an 8085 based pocket calculator size terminal." The way to contact Bob Freedman is by calling him, (617) 683-4659.

BROOK'S LAW:
Adding manpower to a late software project makes it later.

Computer ID

Professor Leon Harmon of Case Western Reserve University has been developing a microcomputer process that will be able to identify faces. His research began with the identification of standard facial features, i.e., chin, forehead, nose. A PDP 11/45 classified a face by analysis of the angles and distances between features. There were considerable difficulties with this approach because one error meant that the computer could totally reject a face.

As the research progressed, Professor Harmon modified the process by assigning a rank order and mathematical value to all of the facial features. The computer then found the correct face in its memory and provided a number which indicated how confident it was of its selection. But, the most interesting development in the research was the pictorial representation of faces. A matrix of 15-by-20 squares and six levels were used to represent a face with the result that the face appears somewhat like a cubist painting. (Figures 1 and 2).

The uses of Professor Harmon's technique and the eventual perfection of the technique to identifying individuals by x-rayed skull portraits are amazing and limitless. It will be possible to screen individuals in high security areas, to do law enforcement checks quickly, and to identify credit card holders, to name just a few of the possible uses.

Photographs courtesy of Blocpix, 972 East Broadway, Stratford, CT 06497. Original photo of Alfred E. Neuman courtesy of **MAD** Magazine, ©1979 by E.C. Publications, Inc.

Figure 1. Albert Einstein.

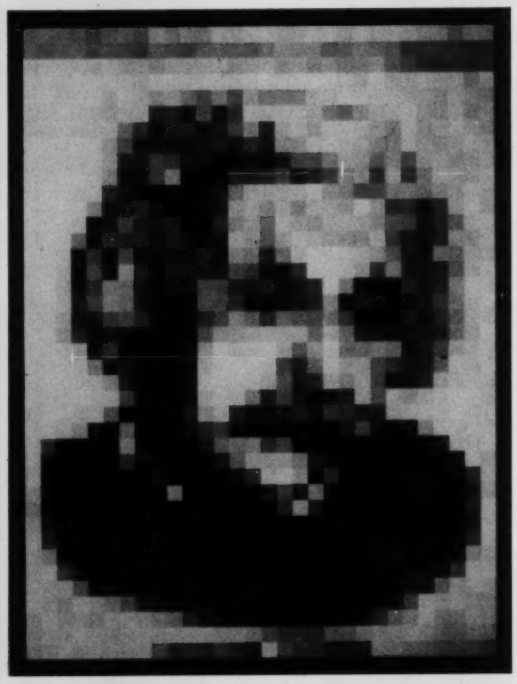

Figure 2. Alfred E. Neuman.

Famous Father-Son Teams That Made the Nation What It Is Today

A Beautiful Way To Interface

SOROC's first and foremost concern, to design outstanding remote video displays, has resulted in the development of the IQ 140. This unit reflects exquisite appearance and performance capabilities unequaled by others on the market.

With the IQ 140, the operator is given full command over data being processed by means of a wide variety of edit, video, and mode control keys, etc.

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The IQ 120 offers such features as: 1920 character screen memory, lower case, RS232C extension, switch selectable transmission rates from 75 to 19,200 bps, cursor control, addressable cursor, erase functions and protect mode. Expansion options presently available are: block mode and hard copy capability with printer interface. The IQ 120 terminal incorporates a 12-inch CRT formatted to display 24 lines with 80 characters per line.

SOROC TECHNOLOGY, INC.

165 FREEDOM AVE., ANAHEIM, CALIF. 92801
(714) 992-2860 / (800) 854-0147

CIRCLE 184 ON READER SERVICE CARD

Input/ Output

Tried and Found Guilty?

Dear Editor:

"Making Friends with that Home Computer" in your April 1979 issue could have been an acceptable article for introducing computers and their usefulness in daily personal affairs. I fail to understand, however, why you allowed it to be ruined by having Lorraine Mecca direct it to the stereotyped wide-eyed ignorant housewife. This article inaccurately represents the people who might be interested in it or benefit from it. By its descriptor "For Women Only" as well as the way it is written it attracts but a small portion of those who could gain something from it. Your accepting such an article for publication shows your lack of intelligence, judgement and class.

Ginny Banerjee
580 Arapeen Dr.
Salt Lake City, UT 84108

Speaking Of...

Dear Editor:

We searched the entire article by Lorraine Mecca, "For Women Only! Making Friends With That Home Computer" (April, 1979), for a hint that Ms. Mecca had her tongue in her cheek. Alas, she seemed to be serious.

We admire her ingenuity in using a home computer to list work she does in a home, but we challenge her assumptions that husbands buy home computers, and their wives are ignorant and dependent.

Many women in our company and others are employed to design computers, write software, sell computers, plan the installation of elaborate computer systems, and train classroom teachers to use computers.

All of us are homemakers, too, with or without husbands to show us how to turn our home computers on. Ms. Mecca should be forbidden to use her home computer for one week as punishment for her several deprecating remarks about housewives' intelligence and resourcefulness.

Computers are not inherently sex biased. In fact, we expect that girls who receive computer-assisted instruction in school will be able to unlearn the helpless behaviors they have been taught to exhibit, especially in mathematics, science, and technical areas.

Please, **Creative Computing**, screen your material carefully and avoid perpetuating the myths about masculine and feminine interests and abilities.

Barbara Schonborn, Ph.D.
Sales Trainer
Computer Curriculum Corporation
700 Hansen Way
Palo Alto, CA 94304

Dear Ms. Schonborn,

We appreciate your thoughtful reaction to the article. All of us think that the article did not adequately depict either the homemaker's role nor the use of a computer. In our opinion, the article denigrated women in the home, the use of a home computer, and, by omission, those professional women in the computer field.

So, we say AMEN! —*CL, MW, JG, NW, BS*

TRS-80 Advanced Programming Features

Dear Editor:

I now own a LEVEL II TRS-80 and as you know the DEF FN statement was not included in the Level II ROM, and the only way to get this statement that I know of is to purchase a disk drive and use TRSDOS. Well, the reason I am writing is to find out if anyone has written a machine language program to put the DEF FN statement in reach of non disk users, they did it for RENUMBER why not for DEF FN?

Bob Martin
911 Buckingham
Windsor, Ontario
N8S 2C9
Canada

The DEF FN (Define Function) statement is available in the new Level II Basic for the TRS-80 from GRT (1286 N. Lawrence Station Rd., Sunnyvale, CA 94086). It sells for $49.95 and we should have a review of it in an upcoming issue. —*JC*

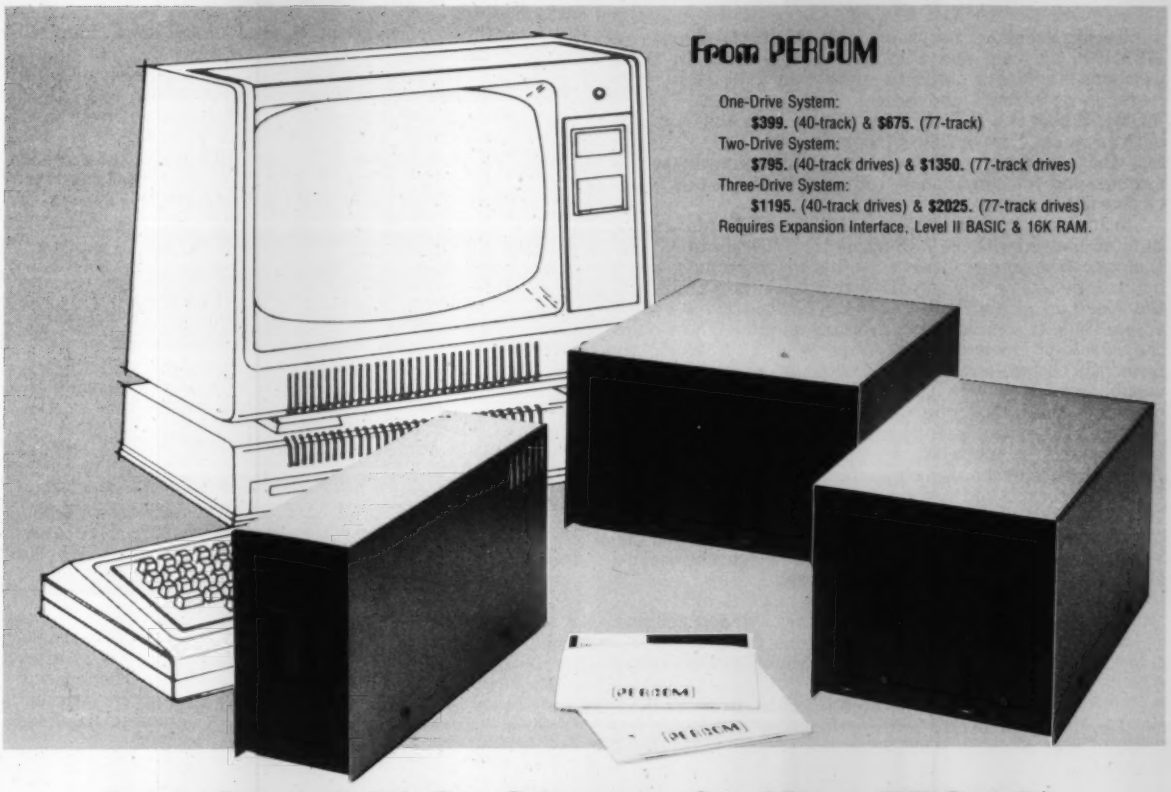
Memory Transplants Updated

Dear Editor:

I hate to be the one who tells you...but your reliable sources (see March '79 Input-Output "A TRS-80 Transplant to a PET!") have let you down. The memory chips for the TRS-80 and the PET are not interchangeable. The TRS-80 uses dynamic memory while the PET uses static. This, of course, is the major difference and the one that prevents interchangeability since the design approach is different (e.g., dynamic memory requires periodic refresh of its contents and uses special signals from the processor to do this while static memory does not require refreshing).

The PET, in various models, uses either the 6550 from MOS technology or the 2114 from a number of semiconductor manufacturers. The 6550 is a 22 pin 4K static memory chip that operates from a single 5 volt supply. The 2114 is an 18 pin 4K static chip that operates from a single 5 volt supply. Due to the pinout differences even these two types are not directly interchangeable so you need to know which one your PET uses. It is, however, relatively easy to add additional memory to the PET by making your own board and plugging into the memory interface connector provided. Then you can use almost any 5 volt static chips you please. I did this about a year ago to add on additional 8K internally. I mounted the board piggyback to the main boards and used 2114 chips even though my PET uses the 6550 (more expensive) chips. Except for the memory chips it only required 4 other chips for address decoding since much of this is already provided by the PET's design.

The TRS-80 and the APPLE II (and some other machines - the Sorcerer and the Compucolor as far as I know) use dynamic memory in either the 4K or the 16K flavor (in the APPLE at least, there can be a combination of both types in sets of 8 each). Both the 4K and 16K chips are in 16-pin packages and operate from +5 volts, -5 volts and +12 volts. These chips are available from most of the major memory chips manufacturers, however, most of them use different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numbering schemes. As an example, Motorola provides a MCM4096 4K chip and a MCM4116 16K chip. To these numbers is added a suffix to specify the type of package (ceramic or plastic) and access time or speed. Thus a MCM4116L-20 is a 16K dynamic chip in a ceramic package with an access time of 200 ns (nanoseconds). Add to this the fact that every manufacturer uses different numbering systems and you can see how confusing memory chip interchangeability can be.

In any case, it all boils down to this: the PET chips cannot be interchanged with the TRS-80 but the TRS-80 and APPLE II chips can be (and probably any other microcomputer using dynamic memory). The only thing that might be a problem is the speed or access time. The APPLE likes 250ns or less access time. If some other type machine uses slower chips they would probably not work properly in the APPLE. The faster the better - any of the microcomputers on the market should work well with 200ns chips. So when thinking of changing - check the access time. Keep in mind also, that the 4K and 16K dynamic chips cannot always be mixed in a machine but in machines where they can (such as the APPLE), they must be in groups of 8. In the APPLE there are 3 rows of 8 sockets and each row can be filled with either 4K or 16K chips. Also, each row has an additional socket where a set of jumpers (in an IC type package) is inserted to tell the computer which type of memory that row contains (4K or 16K). The TRS-80 has a similar arrangement.

Well, John, I hope this clarifies the issue a little.

Jerry Petrey
Electronic Design Engineer
Jet Propulsion Laboratory

Jerry called soon after writing this letter and said he had learned that the new PET, with the standard keyboard, uses dynamic 4116 (16K) chips. Perhaps thats where the interchangeability idea originated. JC

Space Saver

Dear Editor:

In the printing of the article "Space Saver," in the March 1979 issue of **Creative Computing**, two footnotes that are referenced several times in the article were omitted:

Footnote 1: The first time through the procedure "next" = "first."

Footnote 2: The IF . . . THEN statement functions in a way that is not completely described in the language reference manual. Given the program
10 IF XXX THEN YYY / STATEMENT 1 / STATEMENT 2 20 STATEMENT 3
When XXX is false and YYY is a line number, control passes to the next statement, namely STATEMENT 1. When XXX is false and YYY is a statement, control passes to the next sequential line, namely line 20.

Also, in the article itself, the typesetter used a colon (:) rather than a backslash (/) as the separator for multiple statements on a line. This did not affect the program listing, however, since that was an actual copy.

Andrew R. Nicastro
Director of Computer Assisted Learning
The American School of The Hague
High School Division
Paulus Buysstraat 51
The Hague
Netherlands

Picking at "Peeking and Poking"

Dear Editor:

In regard to the application article by Rod Hallen in your February/79 issue, some corrections are in order. Since it is an interesting article, I expect the readers to try some of the programs in there and a lot of frustration could be avoided if the following corrections are incorporated:

1. The correct location of PET screen is from 32768 to 33767 (inclusive) for a total of 25 lines times 40 characters.
2. In a PET computer POKE 32768,1 will place an "A" in the upper left hand corner of the screen and POKE 33767,26 will cause a "Z" to appear in the lower right hand corner.
3. PET does not use "the same ASCII codes" as given in Table 1. For example "A" to "Z" are coded as 1 to 26 etc. One can find out these codes from the results of PROGRAM B.
4. In PROGRAM B, line 40 should read
   40 for I = 1 to 255
   otherwise, there would be an error message, because codes 256 to 1000 cannot be interpreted by PET. To "fill out the screen" (at least partially) one can modify line 50 to
   50 POKE S+2*I,I
   but then, of course, the first letter A will be one place shifted to the right, i.e., it will begin from location 32769 rather than 32768.
5. Finally, a word of caution to the PET users. Locations 32848 to 32853 (first six positions of the third line from top and location 32888 (first position of the fourth line) are reserved for READY, message and cursor respectively; hence, anything written there will be overridden by the monitor message or the cursor. To avoid this problem, one could change line 30 to
   30 LET S = 32887

Finally, the article was very interesting indeed.

Rabin Chatterjee
Master
Electrical & Electronics Engineering
Technology Department
Centennial College

Help From PDP-11 Users?

Dear Editor:

HELP!! We have a DEC PDP 11v03 Computer system, on which we are running RT-11, version 2, and MUBAS, version 1 (single job monitor). We would like to be able to run 4 floppy diskette drives, instead of just the 2 that are part of the original system.

We have the equipment, have made patches to the monitor, and, in fact, are able to handle all 4 floppies in the usual way with PIP. However, error messages ?DEV and ?DNE result from all attempts to access the extra 2 diskette drives in MUBASIC.

DEC says that it appears that what we are doing should work. Any and all suggestions will be most welcome.

Leslie R. Tanner
Mathematics Department
Jamestown College, Jamestown, ND 58401

Is Updating Called For?

Dear Editor:

It has seemed to me that published computer programs are following Gresham's Law: The bad drives out the good. In my opinion, many published programs are of mediocre quality. Now this is not the fault of you or the other editors; you can only publish what is submitted. But once a program on a given subject is published, then the publishing of further programs on that subject is inhibited, even if they are superior to the original program. This encourages authors/programmers to quickly put something together and send it off without refining it, to beat out the other authors/programmers who may get the same idea. It also discourages sending in refinements/improvements to already published programs. The result is that we almost never have the best programs on a given subject available as published programs.

I do not know the best solution to this problem.

Perhaps any submitted program that was on the same subject as a previously published program could become eligible for a new monthly feature:

The Best New Program on an Old Subject.

With a suitable prize, this might attract some good programs.

Delmer D. Hinrichs
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CIRCLE 111 ON READER SERVICE CARD

North Star Criticism

Dear Editor:

This is to take issue with any praise that may have been intended for North Star Computers in your article on page 54 of the Nov/Dec issue of Creative Computing.

It is my experience with North Star that they are an arrogant bunch of SOB's who have a good product primarily because their customers have corrected their mistakes. Further, they will not respond to questions from purchasers unless you happen to be an OEM manufacturer.

I have been trying to a year to find out how to obtain mathematical precision in excess of 8 bits. They claim that up to 14 bits is available...but, if they won't talk to me, how can I place an order?

As a result of some recent investigations, I am not sure that I want any more of North Star Computers. In your Jul/Aug '78 issue, on page 70, there is an interesting program by George Ball for computing pi by using an inscribed square and then increasing the number of sides in an iterative procedure to approximate the value of pi. If you will note carefully, even with 536,870,912 sides the approximation is still a trifle too small. I have written this program in North Star Basic, Ver. 6 (DOS Ver. 2), and have come up with an incorrect value for pi (as per North Star Basic). The program comes up with pi equal to 3.1415924. It should be 3.1415926. The next thing to note is that after 4096 sides have been used then all the values of pi that follow are too big. This is impossible for an 'inscribed square' and is not in agreement with George Ball's results.

It seems impossible not to conclude that the North Star Basic computation scheme is at fault and defective in some subtle way.

Felix Montro
334 Olney Dr.
San Antonio, TX 78209

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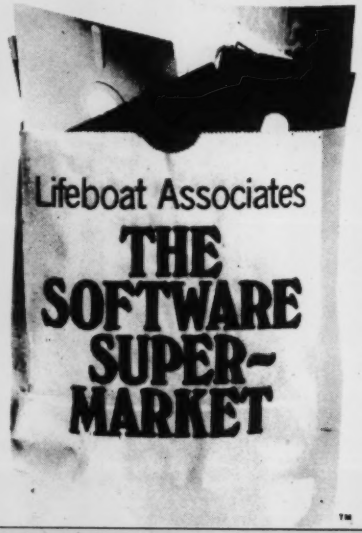


CIRCLE 157 ON READER SERVICE CARD

Response From North Star

Dear Editor:

Thank you for the opportunity to respond to Mr. Montro's letter. There may well be others among your many readers to whom our products and/or policies are not quite clear.

While we are always happy to answer questions from individual users, we certainly cannot provide by mail or phone the kind of support that a local dealer can provide in person. For this reason we always encourage people to buy our products through their local dealers rather than directly from us. Our non-standard precision BASICs, for example, can be easily obtained through any of our dealers.

We have tested the convergence program that Mr. Montro refers to using 8, 10, 12, and 14 digit versions of Release 4 North Star BASIC. Our results were 3.1415924, 3.141592648, 3.1415926524 and 3.141592652422. This agrees both with Mr. Montro's results and with Mr. Ball's results. The discrepancy of different last digits results from the cumulative error inherent in an iterative calculation. It should be noted that North Star's decimal arithmetic offers no particular advantage when dealing with irrational numbers.

Thanks again for the opportunity to respond.

Peter Midnight
Arrogant SOB
North Star Computers

Pascal's Triangle

Dear Editor:

Being a proficient APL programmer, I was quite displeased with the inefficiency of the Pascal's triangle program in the March issue. It is possible to write this program in only two statements:

```
     ∇ M PAS N;P
[1]    P←,1
[2]    L:→L×N≥⍴P←(0,P)+P,0,0⍴⎕←((0⌈M-⌊0.5×⍴⍴P)⍴' '),⍕P
     ∇
```

This program also has the added feature of printing the triangle in a "christmas tree" form rather than in the right triangle form in the March issue. One can also control the number of lines printed instead of having an endless loop. Here is the format:

```
66 PAS 10
```

The 66 is the center of your terminal, I.E. the width divided by two. The ten is the number of lines of output to be generated. Here is what the output would look like:

```
                1
              1 1
            1 2 1
          1 3 3 1
        1 4 6 4 1
      1 5 10 10 5 1
    1 6 15 20 15 6 1
  1 7 21 35 35 21 7 1
1 8 28 56 70 56 28 8 1
1 9 36 84 126 126 84 36 9 1
```

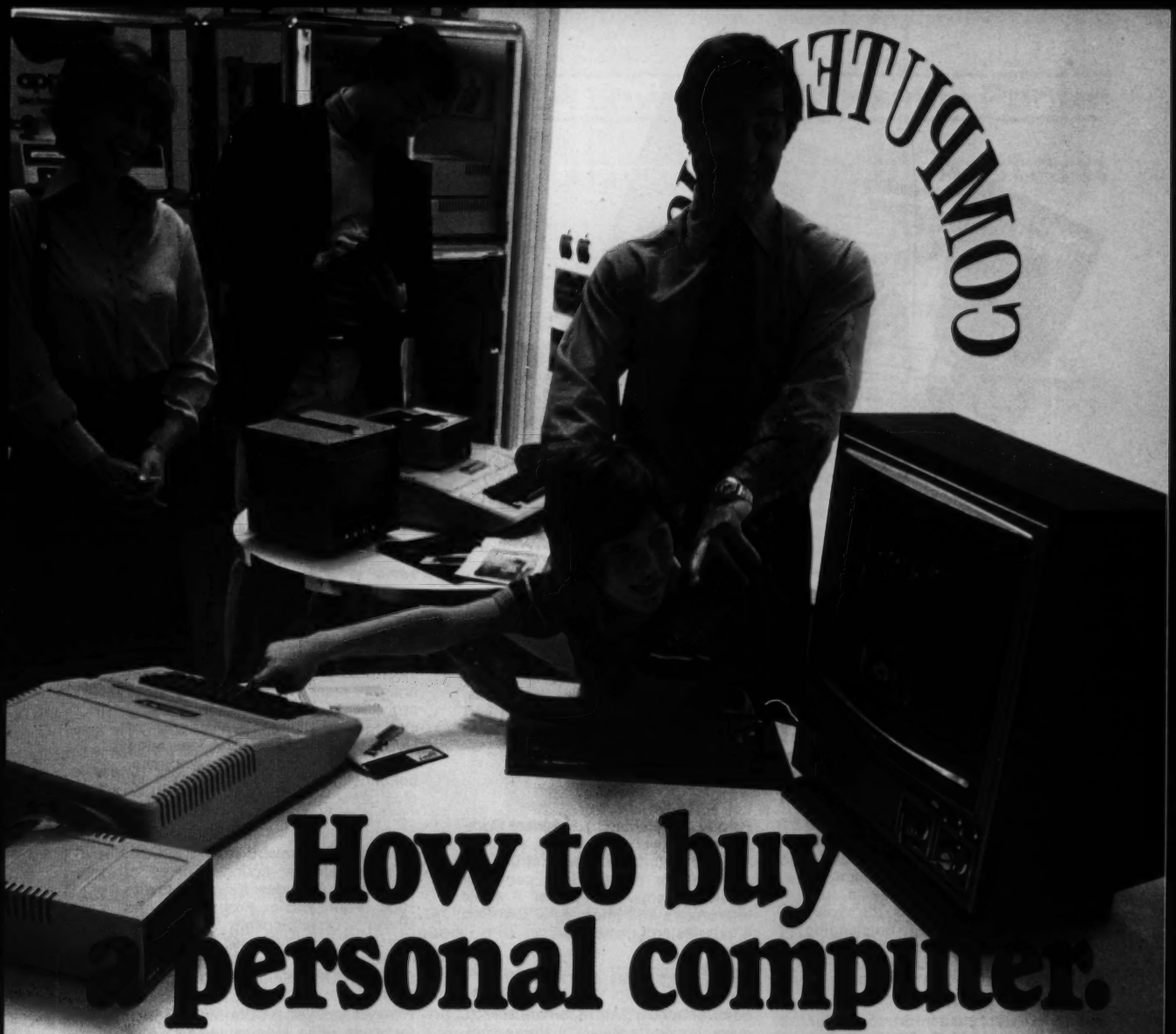
This is a good example of the power of APL. Though it is not considered good programming practice, the program could be written in one statement:

```
     ∇ M PAS N;P
[1]    ⍎(-7×0≠⎕NC 'P')↓'P←1×N≥⍴P←(0,P)+P,0,0⍴⎕←
     ∇

((0⌈M-⌊0.5×⍴⍴P)⍴'' ''),(⍕P),0⍴P←,1'
```

I would really like to see a bit more efficiency in the future. I feel that if APL is used inefficiently, it has no advantage over BASIC or FORTRAN.

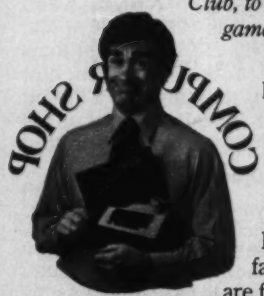
Allen Grannell
Los Angeles City College
855 N. Vermont Ave.
Los Angeles, CA 90029



How to buy a personal computer.

In California, a store owner charts sales on his Apple Computer. On weekends though, he totes Apple home to help plan family finances with his wife. And for the kids to explore the new world of personal computers.

A hobbyist in Michigan starts a local Apple Computer Club, to challenge other members to computer games of skill and to trade programs.



Innovative folks everywhere have discovered that the era of the personal computer has already begun—with Apple.

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A Low-Cost, Versatile Printer

Integral Data System Brighter Writer

Victor K. Heyman

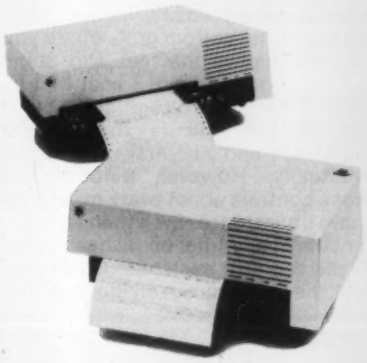
Next to your terminal and computer, the most important piece of equipment you buy is probably a printer. It enables you to communicate with the outside world. It also lets you see your programs better for easier debugging. And, how about those biorhythm charts and home mortgage tables? Yes, I consider a printer to be essential.

In searching for a printer, I had to keep my objectives sharply in focus, I wanted to be able to write articles and letters, produce mailing labels and do the kinds of small printing jobs mentioned above. If I wanted beautiful hard copy for photo-offset, I would have chosen a solid-type impact machine like the Selectric or the Diablo. If I had heavy-duty printing in mind, I would have gone for a line printer, or maybe the Diablo or Spinwriter. However, I didn't want to blow a big wad on top of what I spent for my computer, at least not right away. The printer market is changing rapidly. The quality of dot-matrix printers is improving and prices are generally declining at the same time that quality is rising. Nice time to be alive, isn't it?

My choices for a relatively low-cost, full-size printer quickly came down to the Integral Data System (IDS) 125, the 225 and a few others. I went for the IDS 225, and that is what this review is all about. At the same time, I'll comment on the 125, which is the little brother of the 225, with friction feed instead of pin-feed.

Primary Features

The BrighterWriter is a 7x7 dot matrix impact printer. It has full ASCII upper and lower case characters. As with most dot matrix printers, the "q", "p", "y" and "g" do not "descend" below the line, a topic I will discuss a little later. As an impact printer, it uses very fine wires, solenoids, and a typewriter-type ribbon. The 225 features adjustable-width pin-feed tractors for precise control of fan-fold paper and continuous forms, for paper up to 8½" wide.



IDS Models 125 and 225 printers.

Both the 125 and 225 have serial baud rates that step from 110 to 1200. The 1200 rate works out to a sustained throughput of 50 characters per second or 120 words per minute.

Also standard on both the 125 and 225 is enhanced (double width) character control for printing table headings and titles. In addition, both come with a 256 byte buffer to allow your computer to get a little ahead of the printer. The 225 prints 77 characters to the line in the standard 10 characters to the inch mode. The 125 gives 80 characters to the line, since it does not have pin-feed holes.

The 225 has a standard "forms control" package. The form length controls can be set for eight lengths, from 3" to 14". Then you can set a switch to select an automatic skip of one inch across a forms boundary. The printer actually counts lines, and skips over the last half-inch at the bottom of one page and the top of the next. These features can also be used through program control. You can move from the middle of one page to the top of the next page on command.

Optional Features

It is also possible to get variable character density by choosing between 8.3 characters per inch (super-pica), 10 characters (pica), 12 characters (elite), or 16.5 characters per inch (mini-elite). Ever wish your typewriter could switch between pica and elite at a command? I have. I generally like pica, but sometimes want to get more on each line with elite. Now I have both. Mixing these two sizes in the enhanced characters gives really dandy chapter titles and subheads. Ever try printing mailing labels and see those names running off the side of the label? I have, but not since I got mini-elite. Now I get up to 50 characters on my 3" labels instead of 30. Funny how names and addresses seem to need 40 characters. Furthermore, with a maximum printing area of a little less than 7½" per line, mini-elite gives 126 characters per line, which means you can reproduce most texts designed for wider printers. Is it readable in that small size? Yes, in fact, since every dot still gets printed, but more compactly, the print seems sharper than regular. You can control print size by program too.

```
AaBb
CcDd
EeFf
```

You can also get a bigger buffer, either 1024 characters or 2048, the latter being a full CRT screen. With a little ingenuity, you can get your computer to output to both your CRT and your printer, with the CRT being a page ahead of your printer. I sometimes catch mistakes that way. It saves paper, but more importantly it saves time. I like the bigger buffer.

How about a special graphics

Victor Heyman, 1706 Lorre Dr., Rockville, MD 20852.

option? You get the bigger buffers, the variable character sizes and also a set of special graphics symbols. Most of the symbols from the PET, for example, are completely reproducible. In fact, you can control the printing of every dot! And with the pin-feed drive, you can do 1/3rd line vertical tabs, overlapping one line with the next for special effects. Considering that the bigger buffer and the variable character size options add up to just $10 less than the full graphics package, Integral Data Systems really is throwing in the graphics almost for free!

Cost

The basic 225 costs $949. Add all the goodies, and you are up to $1149. I took mine home for that, complete with interface cable and sales tax, but list prices are up a little, and the cable and tax may be extra now. The basic 125 is $799 but lacks both tractors and the forms control package. I haven't seen another printer to compare with the 225 with its extras for anywhere near the price.

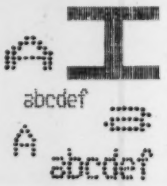
Design Considerations

I have mentioned many of the design features that I like. Heading the list are the variable sized characters, the precise alignment made possible by the pin-feed tractors, the form feed controls and the big buffer. I think it is inherently a sound design.

However, there are several design features of the IDS 225 you may not like. First, the maximum width of paper it can handle is 8½". The minimum width of pin-feed paper that has perforated edges is 9½". That means that you cannot buy paper with perforated edges for the 225. In other words, you will have to learn to live with holes in all of your printing. As beautiful as the text or graphs may be, they will be put on pages with holes! Why? Because IDS made the 225 from the 125 as an afterthought. The 125 uses friction feed (if you can find fan fold paper without holes, it will take it nicely). IDS estimated that a new paper carrier would require too much retooling and would be too expensive. Not a very good reason if you expect to sell very many, but there it is. Serious defect? Yes. Can you learn to live with it. I have, but only because I have a good paper cutter. I sometimes trim my reports down to 8" wide, trimming off one set of holes and hiding the other set in the binding of a report folder. With letters, I often trim off both sides, leaving the pages 7½" wide. Not bad.

Another feature for you to consider. Remember, I said that q's, p's, y's and g's do not descend below the line. Most dot matrix printers do not have descenders that descend. If you want them, you will need to look elsewhere.

Another design feature for which I have little love is the placement of the switches for automatic forms control and character size. They are not on the front, or under the lid where you can get at them easily. Instead, they are inside the bottom grill, where you have to remove the feet and some screws to get to them! I beat that by leaving off the bottom grill, but I suspect the grill is there for a purpose, and I may regret it eventually. However, since I use those controls about every other day, I have little choice. Even then I have to turn the poor printer on its head to get to the tiny DIP switches. Somebody took the easy way out on that one.



Finally, the 225 is slightly noisier than the 125. The 225 has one-third line spacing in order to give the graphics capability I wanted. I can even do 1-1/3rd line spacing if I don't want to double space text and yet want a roomy appearance. The price is that the tractors click 3 times for each paper advance, whereas the 125 has a very quiet line feed. This is not to say the 225 is noisy. It isn't. In fact, I have it in my study next to my bedroom and have gone to bed with it printing merrily away on a 30 page report. Nevertheless, you might want to consider this when you choose between the 125 and 225.

Performance

How well has it worked? Very well. I did have an initial problem, due to the cable not coming with the pins properly set for my Horizon and my Horizon not being jumpered to recognize that it had a printer attached. This was solved by a swift trip to the store that sold me my Horizon. Based on this adventure, I would suggest that you try to deal with a distributor that also sells your computer. Otherwise, be aware that more than a plug may be needed.

Second, I had the devil's own time getting the paper alignment exactly right so that the paper didn't get cocked in the carrier, causing the tractors to tear out the pin-feed holes and cease feeding paper at all. This turned out to be overzealousness at the factory. They had installed tight leaf-springs holding down the paper pressure plate, preventing free movemove of the paper. IDS suggested I remove the springs by just taking out four screws. It worked like a charm.

The final performance factor that wasn't so hot was the darkness of the print. It looked great at the start but is now too light. The ribbon is ½" wide, 18 yards long, double spooled, with re-inking rollers that are supposed to keep everything black for 5 million characters. I got dried up rollers, even though they are supposed to have a year's shelf-life. No big deal, except that you have to get your 'Ribbon & Inking Roller Set' for $12 from your IDS distributor or from the factory. You can't re-ink the rollers yourself and it isn't a standard office supply item.

Aside from these relatively minor problems, my IDS 225 has performed yeoman service for the past 10 weeks with no complaint and no need for service. It seems like a solid product that will serve well for years.

Overall Rating

There you have it. The Integral Data System 225, a dot matrix impact printer with an amazing variety of features, an excellent price and the promise of good reliability based on simplicity. You have all the imperfections I know of. Interested in buying it? Would I buy it again if I had my money back?

I would give the IDS 225 a B+ rating. It is an excellent buy for the money, but only you can decide whether the shortcomings warrant spending more money on another printer. If I had to do it over, I probably would make the same choice. I like it, and it meets my needs very well. □

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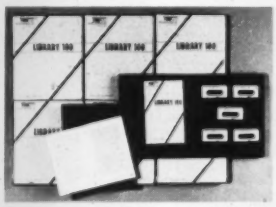

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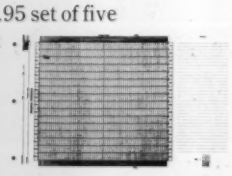

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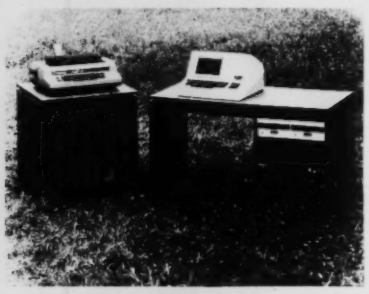
CIRCLE 113 ON READER SERVICE CARD

The Graphics Terminal: SWTP's CT-82

Clay Abrams

In addition to being one of the best-looking terminals on the market, the CT-82 has some worthwhile capabilities in general and specialized applications.

When I heard of Southwest Technical Products (SWTP) new CT-82 Terminal I was mildly interested. The advertisement led me to believe that it was just another terminal. My interest gradually increased because I had known for sometime that I had outgrown my old SWTP CT-1024 terminal. I sent away for more information and after studying the specifications I found that the terminal would meet my present and future requirements.



The CT-82 terminal.

As the title implies, this article will discuss some graphics applications for the CT-82. I have been interested in graphics for some time and all of my recent home computing efforts have been oriented towards Amateur Radio Slow Scan Television (SSTV) generation, reception and enhancements. Much to my surprise some of the SSTV software and hardware which I developed could be applied directly towards CT-82 graphics. In this article I will discuss both general and specific applications of the CT-82 graphics and provide software to accomplish hex to decimal conversion and display pictures on the terminal.

Clay Abrams, 1758 Comstock Ln., San Jose, CA 95124.

Terminal Overview

Intelligent terminals like the CT-82 are quite different from the normal garden variety terminals. Terminals commonly called "dumb" are used to display character data. They are mainly designed with discrete TTL logic hardware and respond to simple commands like carriage return and line feed. Many manufacturers of dumb terminals compete with each other by adding more functions to their terminals. Each time a function is added the component count increases which results in higher costs and physical size. In 1978 a number of IC manufacturers introduced a specialized breed of IC's called CRT controller chips. The CRT controller chips replace about 40 IC's and allow you to control the CRT Display directly by software. This technique allows display terminals to be designed with a fewer number of components and have greater function than possible with the so called "dumb" terminals.

The new CT-82 is one of the first of a new breed of low-cost terminals which contain intelligence. The intelligence within the terminal allows you to control all functions within the unit by keyboard entries or by commands from the system. These commands are high level functions and allow you to perform 128 different functions. The electronics within the CT-82 is contained on two large circuit boards; one for video and the other for the controller. The controller is a 6802 microprocessor with 2K of control program. An additional 2K control ROM socket is provided for possible update. I'm sure Southwest has something in mind?

The video board contains a 6845 CRT controller chip, which allows the terminal to do all of its fancy tricks under software control. The CT-82 is supplied with a ROM chip to display upper case and lower case characters. A second ROM chip can be generated or purchased from Southwest. I decided to purchase their graphics ROM chip for $20.00. This ROM is required if you wish to duplicate my work.

Since you are now familiar with what intelligent terminals are, you may ask the question why should I buy one? Well, a lot of the same tricks that the CT-82 does can be accomplished with a video board for less cost. However, three disadvantages lie with this approach.

1. Video board software is difficult to write, and it is probably not provided with your board. Also, this software is part of the 65K limit of your CPU's memory.
2. If you upgrade your system with a new CPU (e.g., a 6809) all of your video board software must be rewritten.
3. Video boards use system memory and CPU time. These two factors can be very significant if you plan to use graphics.

Intelligent terminals like the CT-82 resolve all these problems. Since I plan to upgrade my system to the 6809 when it is available, all of my 6800 generated CT-82 software could be directly applied to this new processor. With technology advancing at a fast pace, your graphics software can remain viable if you use an intelligent terminal.

CT-82 Graphics Theory

To analyze all of the 128 CT-82 commands in a single article would be a large task. When you read CT-82 manual for the first time it is overwhelming. The CT-82 language is similar to many high level languages. Commands can be issued from the CT-82 keyboard or from the system by software. An example of issuing a command from BASIC follows:

```
PRINT CHR$(X); CHR$(Y)
```

Where X and Y are the decimal value of the command. If BASIC is used to output commands make sure that semicolons are used between the two command bytes (which prevents the outputting of spaces).

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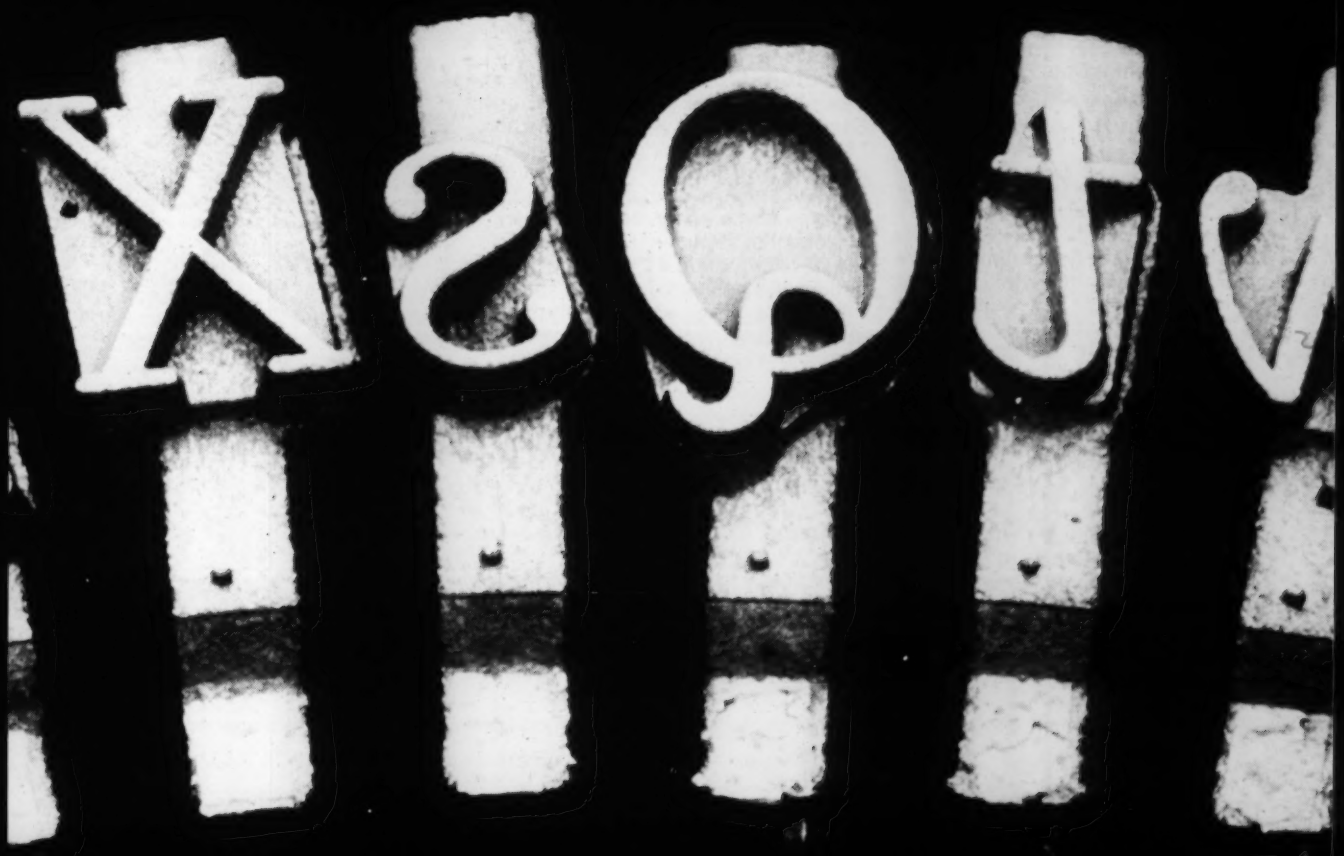

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CIRCLE 103 ON READER SERVICE CARD

XEROX

The CT-82 has three types of commands possible in the graphics mode. These commands address character dots (pixels) lines (horizontal and vertical coordinates on the graphics screen). With the terminal placed in the graphics mode upper case characters can be placed with the pixels. The density will be as follows:

Characters:	92 Characters/line 22 lines/screen
Pixels:	184 Pixels/line 66 lines/screen

The characters must be issued as upper case. If lower case characters are selected a set of pseudographic characters are available. These pseudographic characters have a format of 2 pixels wide by 3 pixels high. Southwest did not provide a listing of the dot pattern which correspond to these characters. The patterns can be easily determined by trial and error with the keyboard. In my early experimentation with the CT-82 graphics I found that two commands satisfied most of my immediate needs. These commands are:

Set Graphics Dots: 1D 13 (H) (v)

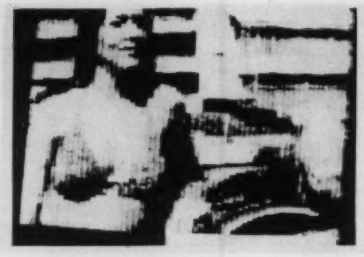
Set Graphics Line: 1D 03 (H1) (V1) (H2) (V2)

The graphics line and dot commands can be executed by assembly language or by Basic. The (H) and (V) notations after the two commands are hexadecimal coordinates for the vertical or horizontal positions of pixels on the screen. I found a very convenient method to determine the coordinates for the graphics dots or characters. This method was to layout the CT-82 screen on graph paper. Both the horizontal and vertical axis were identified with coordinate positions in both decimal and hexadecimal. I placed the graph paper into a clear plastic folder. I then took a grease pencil and drew the display pattern on the plastic. Graphics can be entered directly from the keyboard and modified by trial and error using this technique. With this background let's discuss some applications and I'll provide some examples of CT-82 graphics.

Graphic Applications

1. Image Processing

Display images on the CT-82? It's not only possible...they look fairly good. With the CT-82 capability of addressing pixels on the screen directly, I decided to try some image processing.



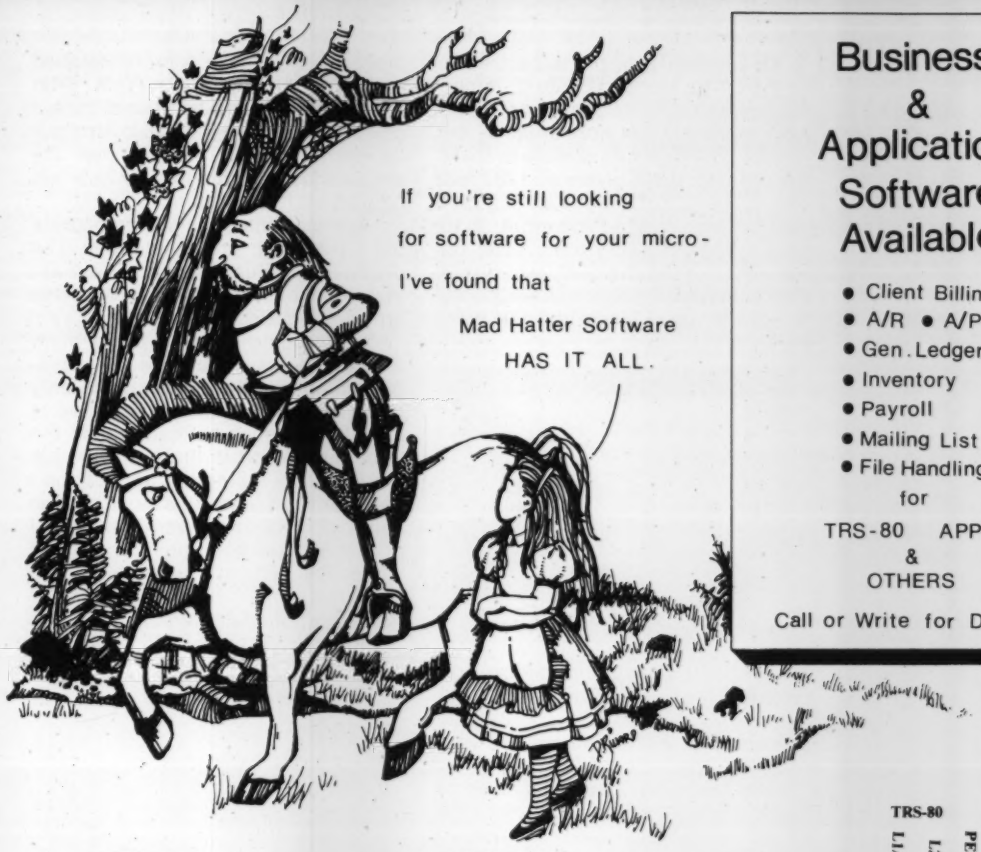
1. Gray level picture displayed on a TV set from a special interface card.

The biggest trick in displaying pictures is getting the picture into the computer memory. I have been doing this sort of thing for years, therefore, I had no difficulty. The articles in reference 1 will provide a little background on the subject. Photo 1 demonstrates the quality of the digitized gray level picture in RAM. This photo was taken of a picture I loaded into my SWTP 6800 system and displayed on a video monitor. The monitor was connected to a special video interface card I designed which uses a 6845 CRT controller chip. This card plugs into the SS-50 bus and by direct memory access techniques displays a gray level picture contained in RAM on a normal TV set. For those of you who are interested, an article will appear in "Ham Radio Magazine" describing this video interface card along with its software.

With a gray level image in RAM the picture can be scanned by software and direct control pixels displayed on the CT-82. Program A is a source code listing of a program which displays the picture at address 0000 through 3FFF on the CT-82. The program is started by executing address 6000.

Program A. Source Code to display a picture on the CT-82 Terminal.

```
                        *
                        * PROGRAM TO DISPLAY
                        * A 2 BRAY LEVEL
                        * PICTURE ON THE
                        * SWTPC CT-82 TERMINAL
                        * WRITTEN BY D M FERRIS
                        * 3/14/79
                        *
A014                    ORG     $A014
                        OPT     PAG,NOS
                        *
E14C            INEEE   EQU     $E14C
E104            OUTEEE  EQU     $E104
E07E            OUT     EQU     $E07E
                        * CONSTANT STORAGE
                        *
A014 00         HORIZ   FCB     0
A015 00         VERT    FCB     0
                        *
6000                    ORG     $6000
                        *
                        * DISPLAY A PICTURE
                        * MAIN LINE
                        *
6000 BD 60 09   DISP    JSR     GRAPH
6003 BD 60 B4   DISP2   JSR     POS
6006 CE 60 1C           LDX     #MENU
6009 BD E0 7E           JSR     OUT
600C BD E1 AC           JSR     INEEE
600F 81 31              CMPA    #$31
6011 27 07              BEQ     DISP1
6013 81 30              CMPA    #$30
6015 27 00              BEQ     DISP0
                        *
6017 7E 60 96   DISP0   JMP     CHAR
601A 20 1D      DISP1   BRA     PICT
                        *
                        * MENU
                        *
601C 4D         MENU    FCC     /MONITOR=
0,CT-82 DISPLAY=1 ? /
601D 4F 4E
601F 49 54
6021 4F 52
6023 3D 30
6025 2C 43
6027 54 2D
6029 38 32
602B 20 44
602D 49 53
602F 50 4C
6031 41 59
6033 3D 31
6035 20 3F
6037 20
6038 04                 FCB     4
                        *
                        * PLACE A PICT ON THE
                        * CT-82
                        *
6039 BD 60 B4   PICT    JSR     POS
603C 86 1C              LDAA    #$1C
603E BD E1 D1           JSR     OUTEEE
6041 86 03              LDAA    #$03
6043 BD E1 D1           JSR     OUTEEE
6046 7F A0 14           CLR     HORIZ
6049 7F A0 15           CLR     VERT
604C CE 00 00           LDX     #0
604F A6 00      PICT1   LDAA    X
6051 84 0F              ANDA    #$0F
6053 BD 60 C6           JSR     XMIT
6056 B6 A0 14           LDAA    HORIZ
6059 91 7F              CMPA    #127
605B 27 06              BEQ     PICT2
605D 08                 INX
605E 7C A0 14           INC     HORIZ
6061 20 EC              BRA     PICT1
6063 BD 5A      PICT2   BSR     POD
6065 7F A0 14           CLR     HORIZ
6068 B6 A0 15           LDAA    VERT
606B 81 3F              CMPA    #63
606D 27 05              BEQ     PICTD
606F 7C A0 15             INC   VERT
6072 20 DB              BRA     PICT1
                        * SLIDE SCREEN RIGHT
                        * WAIT FO K/B
6074 C6 0A      PICTD   LDAB    #10
6076 86 1D      PICT4   LDAA    #$1D
6078 BD E1 D1           JSR     OUTEEE
607B 86 0D              LDAA    #$0D
607D BD E1 D1           JSR     OUTEEE
6080 5A                 DECB
6081 26 F3              BNE     PICT4
6083 BD E1 AC           JSR     INEEE
6086 7E 60 03           JMP     DISP2
                        *
                        * PLACE CT-82 IN
                        * GRAPHICS MODE
                        *
6089 CE 60 8F   GRAPH   LDX     #GRAPH1
608C 20 19              BSR     SEND
608E 39                 RTS
608F 1D         GRAPH1  FCB     $1D,$13,$
1E,$18
6090 16 1E
6092 18
6093 1E                 FCB     $1E,$15,4
6094 15 04
                        *
                        * RESTORE UPPER
                        * CASE CHAR AND
                        * JUMP TO MONITOR
                        *
```



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```
 6096 CE 60 9E  CHAR    LDX    #CHAR1
 6099 8D 0C             BSR    SEND
 609B 7E E1 47          JMP    $E147
 609E 1E        CHAR1   FCB    $1E,$08,$
16,$12
 60AF 08 16
 60A1 12
 60A2 1E                FCB    $1E,$05,$
10
 60A3 05 10
 60A5 12                FCB    $12,4
 60A6 04
                *
                * SEND STRING
                *
 60A7 A6 00     SEND    LDAA   X
 60A9 81 04             CMPA   #4
 60AB 27 06             BEQ    SEND1
 60AD BD E1 D1          JSR    OUTEEE
 60B0 08                INX
 60B1 20 F4             BRA    SEND
 60B3 39        SEND1   RTS
                *
                * SET CURSOR TO
                * HOME UP/ CLEAR
                *
 60B4 86 10     POS     LDAA   #$10
 60B6 BD E1 D1          JSR    OUTEEE
 60B9 86 15             LDAA   #$15
 60BB BD E1 D1          JSR    OUTEEE
 60BE 39                RTS
                *
                * ADD 129 TO X
                * SKIP A SSTV LINE
                *
 60BF C6 81     ADD     LDAB   #129
 60C1 08        ADD1    INX
 60C2 5A                DECB
 60C3 26 FC             BNE    ADD1
 60C5 39                RTS
                *
                * XMIT A GRAY LEVEL
                * DOT - "A" CONTAINS
                * THE GRAY LEVEL VALUE
                *
 60C6 81 09     XMIT    CMPA   #9
 60C8 23 04             BLS    XMIT0
 60CA 81 10             CMPA   #16
 60CC 23 03             BLS    XMIT1
                *
 60CE BD 1B     XMIT0   BSR    LEVL0
 60D0 39                RTS
 60D1 BD 01     XMIT1   BSR    LEVL1
 60D3 39                RTS
                *
                * DISPLAY A GRAY
                * DOT LEVEL 1
                *
 60D4 86 1D     LEVL1   LDAA   #$1D
 60D6 BD E1 D1          JSR    OUTEEE
 60D9 86 13             LDAA   #$13
 60DB BD E1 D1          JSR    OUTEEE
 60DE B6 A0 14          LDAA   HORIZ
 60E1 BD E1 D1          JSR    OUTEEE
 60E4 B6 A0 15          LDAA   VERT
 60E7 BD E1 D1          JSR    OUTEEE
 60EA 39                RTS
                *
                * DISPLAY GRAY LEVEL 0
                *
 60EB 86 20     LEVL0   LDAA   #$20
 60ED BD E1 D1          JSR    OUTEEE
 60F0 39                RTS
                *
                        END
      NO ERROR(S) DETECTED
```

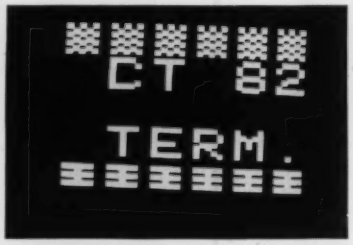
The entire picture is first placed on the left hand side of the the CT-82 display. Another routine issues 10 slide right commands (PICT3) which centers the picture on the screen.

As you can see, the aspect ratio for the CT-82 picture (Photo 2) is not quite correct. This is due to the CT-82 pixel format of 184 horizontal by 66 vertical. The digitized picture in RAM has a format of 256 pixels on 128 lines with 16 gray levels. My scanning rate with the software in Program A, is to send the CT-82 every other pixel on every other line. The gray level pixels are translated to either spaces (black) or a CT-82 pixel (white) by the software.

2. Picture displayed on the CT-82 Terminal.

The picture generation process on the CT-82 is quite slow at 1200 baud (2 minutes). I'm sure if my CT-82 was operating at 9600 baud the transfer rate would be more tolerable.

The image can also be made up of block letters. Photo 3 shows the CT-82 displaying block letters. I developed this character generator routine last year for Amateur Radio SSTV. As you can see, the results are quite striking on the CT-82.



3. CT-82 Terminal with block lettering on the display.

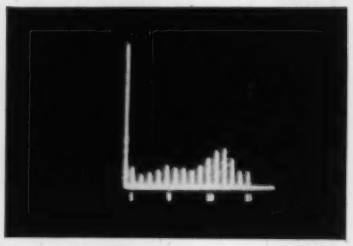
2. Histograms and Plotting

One of the most useful applications of graphics on terminals is to display data. Numerous applications exist in business and engineering to analyze data in graphical form.

The CT-82 is very powerful in this type of application. With the line generation capability histograms or bar charts can be made very quickly. Photo 4 is an example of a simple histogram which I wrote to analyze the picture in Photo 2. In this histogram the X axis corresponds to the gray level values in the picture. The Y axis corresponds to the number of gray level points at each of the 15 gray levels. I plan to expand on this program to provide a more detailed analysis of the picture in RAM. With the histogram, and additional data, I could feed back to the Radio Amateur transmitting SSTV pictures over the air detailed information on how his equipment is performing.

Applications of this type provide the CT-82 with great potential. The displaying of this histogram is almost instantaneous, since only 102 bytes are transferred to the terminal.

Basic could be used in a similar manner to draw the lines. The programming is quite simple since only the end points of the vertical line is calculated, which corresponds to the maximum vertical limit of the bar graph. In my histogram application I kept both horizontal line locations the same and for new vertical lines I added 5 pixel positions to the last value. The vertical line start location was always the bottom most coordinate location. The vertical line stop position was calculated from the



4. Histogram of the number of gray level pixels at each level.

number of readings in each category (1 through 15). The number of readings for each category was divided by 128 and entered directly into the vertical line end position. This software package was quite small and only required 300 bytes of code. Plotting software takes a little more work. I wrote a small plot routine in basic to plot a sine wave. The results were somewhat satisfactory.

Program B. Source code of a program to convert Hex to Decimal with the CT-82.

```
                *
                * PROGRAM TO CONVERT
                * HEX TO DECIMAL
                * USING CT-82
                * C ABRAMS 3/29/79
                *
                * EQUATE TABLE
                *
E147            MIKBUG  EQU    $E147
E07E            OUT     EQU    $E07E
E047            BADDR   EQU    $E047
E1D1            OUTEEE  EQU    $E1D1
                *
3000                    ORG    $3000
                *
3000 BD E0 47   START   JSR    BADDR
3003 CE 00 00           LDX    #0
3006 27 08              BEQ    START1
3008 FF 30 1A           STX    STRING+4
```

```
3008 CE 30 16          LDX   #STRING
300B BD E0 7E          JSR   OUT
300E 20 ED             BRA   START
                *
3010 7E E1 47  START1  JMP   MIKBUG
                *
                * COMMAND STRING
                *
3016 0A        STRING  FCB   $A,$D,$10
,$10
3017 0D 10
3019 10
301A 00                FCB   0,0,$A,$D
,4
301B 00 0A
301D 0D 04
                *
                       END
      NO ERROR(S) DETECTED


   SYMBOL TABLE:
BACDR   E047        MIKBUG  E147
OUT     E07E        OUTEEE  E1D1
START   3000        START1  3010
STRING  3016
```

Plotting requires many more calculations and compute time than bar graphs. To plot the first step is obtain an equation for the function to be plotted. The next step is to determine a scale factor to insure that your data points will not exceed the vertical and horizontal positions of the CT-82. After this check the horizontal and vertical positions can be transmitted directly to the screen. The process is quite simple.

Summary

The results with graphics on my CT-82 has been very rewarding. I hope that this article will stimulate others to experiment with the world of graphics. It can be a lot of fun.

All of my software was written in a few weeks during weekday evenings. This proves that intelligent terminals take a lot of the work out of graphic displays. □

References:

1. SSTV Meets SWTPC, Parts 1 & 2 73 Magazine Nov./Dec. 1978 By: Clayton W. Abrams K6AEP

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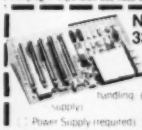

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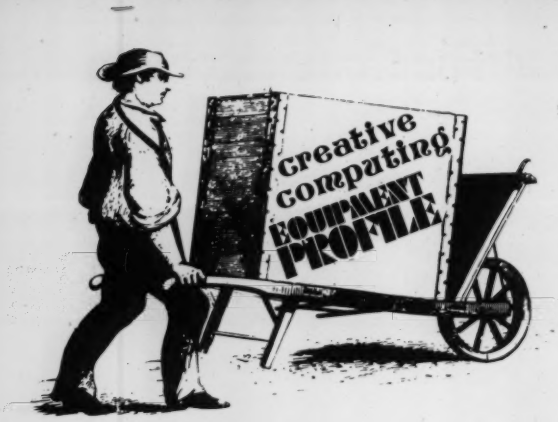

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APF PeCos One

Randy Heuer

In the world of small computers, there are a lot of computers that look alike and act alike. The PeCos One from APF is not like most of those small computers. APF has made a machine that is different in just about every way.

APF's intention with the PeCos One is to provide a user oriented machine that requires little or no computer experience to operate. Rather than adopt BASIC as the PeCos One's standard language, it uses a sentence oriented language called PeCos. Thus this machine represents a new approach toward the personal computer. It attempts to adapt the computer to the person rather than the person to the computer. Just how well this new approach will be accepted, only time will tell.

On the Outside

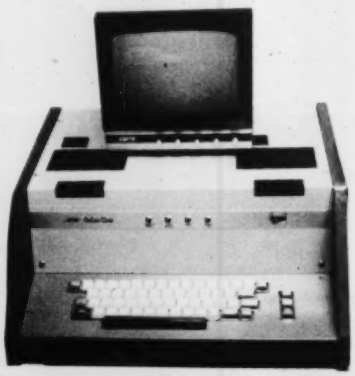
At first glance, you know that the PeCos One is different. The main unit is massive, measuring approximately 19½" x 18½" x 9". Everything except the monitor is contained in this unit including the keyboard and two cassette drives. The two side panels are hardboard with a woodgrain finish, giving the PeCos One the look of a Hi-Fi component rather than a computer.

The keyboard is recessed in the front of the unit. Each key is covered by a clear, plastic cap, making it impossible for the printing on the key to rub off with heavy use. Some of the keys were a bit stiff, particularly the space bar, but for single-finger typists like me this presents little or no problem.

Above the keyboard there is the on-off switch and four LEDs. The LEDs indicate the power is on, the keyboard is ready, an input request and tape operation is in progress.

Located on the top of the unit are the two cassette drives. Cassette operations for the PeCos One are, in my opinion, one of the outstanding features of this machine. A quick glance at the controls reveals the standard EJECT, REWIND and FAST FORWARD, but no RECORD or PLAY. These two controls have been replaced by a single ENGAGE control. The PeCos One knows whether it should be in record or play mode and makes all the necessary adjustments internally. With PeCos One, it is impossible to erase tapes by pressing RECORD when you wanted PLAY (as many of us have done).

Tape operations on the PeCos One are different from anything else I've ever seen. These have been made virtually "Idiot-proof." Only one side of a cassette tape can be used. Tapes must be formatted in a manner similar to floppy disks before they can be used. A special tape head writes addresses or block numbers on one track of the tape. The other track is used for standard information storage. Only the right-hand tape drive can be used to format tapes. Once formatted they can be used in either drive. A special light-controlled sensor in the right-hand tape drive assures that the unit waits for the tape leader to pass the tape head before writing anything on the tape. Altogether, this is the most impressive cassette-based storage system I've seen.



On the rear panel of the unit are several other controls and connectors. A Connector for two additional tape decks, an RS-232C transmit connector, a video output jack and an auxiliary 117V AC outlet are provided. Switches include a baud rate select switch for the RS-232C, the system reset button and an interupt enable-disable switch which can be used to disable the interupt key on the keyboard.

The 9", stand alone monitor is dwarfed by the main unit. The cover of the PeCos manual shows the monitor on a special stand that holds it above the top of the computer out of the way of the cassette drives. Unfortunately, our review model didn't come with such a stand (if it even exists), and when the monitor was set on top of the unit it either blocked access to the cassette drives or hung precariously over the back of the unit. I hope this monitor stand is included with future PeCos One models.

On the Inside

I wasn't up to tearing the PeCos One apart to see what the insides look like, but here's what APF tells us in the manual. The PeCos One employs a 6502 microprocessor. Its interpreter and operating system reside in 24k of ROM and the unit comes with 16k of RAM. Options available for the PeCos One include two additional cassette decks and a lineprinter. No provision for memory expansion or disk drives is presently available.

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mss

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PeCos One, con't....

The 9" black and white monitor displays up to 40 characters per line and 16 lines per screen page. Both upper and lower case letters can be displayed. Unfortunately, the video display circuitry lacks descenders for the lower case letters. Letters such as p and j are displayed with the entire letter above the line. For example the word "Display" would appear as "DisPlaY." This is unpleasant to the eye and generally distracting. In addition, no special graphic characters are available.

Using the PeCos One

The major difference between the PeCos One and other small computers is the PeCos language. PeCos is a variation of the computer language JOSS which was developed by the Rand Corporation. PeCos according to the manual, has been devised "for those who need direct access to a computer, but [have] neither the time nor interest to learn conventional, and complex computer language."

Speaking of the manual, APF has provided a fairly good one for the PeCos One. Its 174 pages cover the operation of the PeCos One computer and the PeCos language in a progressive manner very appropriate for the uninitiated. A quick reference section for review is also provided, although it could be more detailed. Several pages in the manual contained some minor errors, however an Addendum section has also been included. Perhaps future printings will incorporate these corrections into the manual itself.

PeCos is a sentence oriented language, where each program statement is an imperative English sentence. Each sentence begins with a capital letter and ends with a period. The general sentence structure is:

Command verb	Noun(s) separated by commas	Optional modifiers

Command verbs specify the action desired in the sentence. Verbs such as Display, Find, Set and Erase are command verbs. Nouns are variable names or expressions that are acted upon as specified by the command verb. Not every sentence requires a noun. The optional modifiers include "if" and "for" clauses. Here are a few examples of PeCos sentences:

Display Y.

Set P = A + B.

Do part 1 for i = 1,3,5.

Display A + B if Y > 0.

In the indirect (programmable) mode, each sentence begins with a step number. A step number consists of a digit called the part, followed by a decimal point and a fractional component called the step. Thus the step number 11.357 can be expressed as part 11, step 357. A total of nine digits may be used in the step number.

Each part is in itself a separate routine that can be treated as a subroutine. For example here is a program in PeCos that uses a subroutine to input two numbers, sum them and display the sum. This is not the easiest way to accomplish this task, but shows several features of PeCos.

```
1.1  Display "A program to sum
       two numbers."
1.15 Do part 2.
1.2  Set A = Z.
1.25 Do part 2.
1.3  Set B = Z.
1.35 Set C = A + B.
1.4  Display "The sum of A + B
       = ",C.
1.45 Stop.
2.1  Display "Please enter a
       number."
2.2  Demand Z as "Z".
```

To execute this program you would enter:

Do part 1.

In comparison to BASIC, the PeCos language is probably a little less powerful. Variable names in PeCos are limited to single upper and lower case letters (a total of 52), although multidimensional arrays are available. Most of the trigonometric and algebraic functions available in BASIC are available in PeCos, although some such as the tangent must be derived from other functions. No means of interacting directly with memory similar to PEEK and POKE in BASIC is provided in PeCos.

Is PeCos One For Me?

As with most computers, the answer depends upon you and what you expect out of your computer. If your goal is to put all of **Basic Computer Games** on your computer, then you will have a real task ahead of you if you get a PeCos One. Converting from BASIC to PeCos may prove to be a challenge.

However, if you're one of those people who have a real need for a computer and feel that learning BASIC may be too difficult, then you might want to give serious consideration to the PeCos One. APF is to be congratulated for providing the computer buyer with an alternative to the BASIC speaking computer. PeCos One is truly "something different." □

AlgoRhyme

I'm so fed up with ASCII codes
And ITERATION episodes ---
If I had just a human brain,
I think that I would go insane ---
With FILES of DATA to COMPILE
It hardly seems a BIT worthwhile,
I BYTE off more than I can chew
And overwork my CPU,
I'll slip a DISK or blow a fuse ---
That information would confuse
The most logical of us around
And make it INPUT/OUTPUT BOUND --
Then to the CORE send such a chill
To make one TERMINALLY ill.

Anita Westrum

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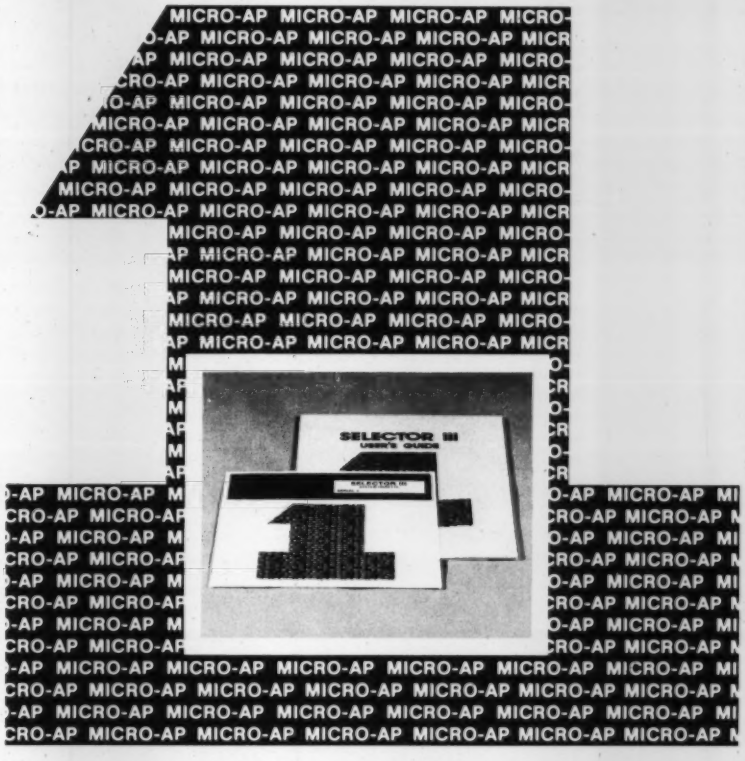

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Voice input for demonstrations, education and other practical applications. Some exciting possibilities!

Heuristics Speechlab

Dr. Larry Press

Speechlab, a product of Heuristics Inc., is a voice recognition system (on a single S-100 board). It is used to digitize sound and pass the information to a computer which is programmed to analyze the sound data.

What Is It?

Figure 1 shows the relationship between the Speechlab System and an S-100 computer. The computer sends one byte commands to Speechlab ("Beep your speaker," "Read out a sample," etc.) and receives digitized information on what is being spoken into the microphone. The interchange between Speechlab and the computer is accomplished via an I/O port which is on the Speechlab board.

Each time Speechlab is commanded to input information, it sends four bytes to the computer. One is an approximation of the overall frequency of the utterance since it was last querried and the other three approximate the amount of energy in three frequency ranges (averaged over time). These three ranges roughly bracket the first three resonances of the human vocal tract.

Thus, if you are interested in "listening" to 2 seconds of speech and wished to sample the incoming sound every 10 milliseconds, you would end up with 800 bytes of information in memory.

In addition to hardware for digitizing sound in the manner outlined above, Speechlab comes with some useful software. It includes a demonstration program theoretically capable of "learning" and recognizing 64 different utterances, a subroutine for inputting speech (the number of samples to be input and the time interval between samples are the parameters), and a version of "Palo Alto" Tiny Basic with the speech input subroutine included.

Alan Porter, owner of Mission Control Computer Store in Santa Monica, CA (with Larry Press), tells his store fan when to turn on and off using a Speechlab voice recognition board.

Last but not least, Speechlab comes with two manuals — one on assembly, test and principles of operations and a book of experiments. The manuals and software are outstanding and I will return to them later, but first let us ask who would want a Speechlab?

Who Is It For?

I can think of three reasons why a person might wish to purchase a Speechlab: for a cute demonstration, for some practical application, or in order to learn about linguistics and pattern recognition. I would rate Speechlab as "okay" for demonstrations, limited for practical applications, and fantastic as a learning tool.

If you are interested in a cute demonstration, you can have it using Speechlab and the demonstration program which comes with it. For instance, at a local computer store, they switch the fan on and off using Speechlab in conjunction with an AC controller (see photo). In a case such as this, where the system is trained to recognize one person's voice, where the ambient noise is low, where there are only a few utterances to distinguish amongst, and where the operator is able to alert the computer when it is time to "listen" for a command. Speechlab is fairly reliable and makes a satisfactory demonstration.

Unfortunately, if these conditions are not met, Speechlab is not very reliable. When I first tried the demonstration program which came with Speechlab, I was disappointed in that it became quite unreliable after training it to discriminate between only four or five phrases under ideal conditions. This limited performance could be due to either inherent limitations of the Speechlab system or to a poorly written demonstration program.

Inherent Limitations

In looking at the commercial speech recognition systems which are marketed by Threshold Technology and Scope Electronics for practical applications, we note that information is gathered in 19 and 16 frequency ranges respectively, rather than in just three as with Speechlab. This limited information is one inherent problem if you are thinking of practical applications.

Dr. Larry Press, Box 5429, Santa Monica, CA. 90405.

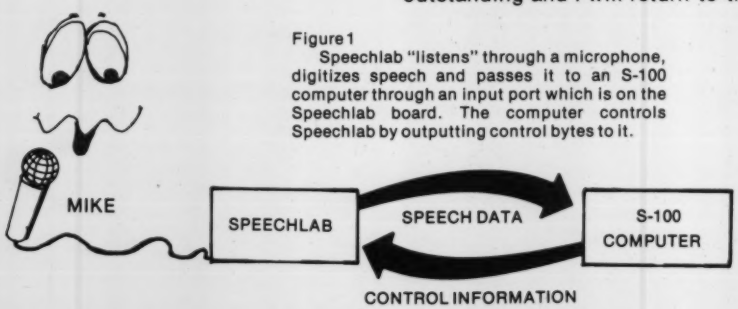

Figure 1
Speechlab "listens" through a microphone, digitizes speech and passes it to an S-100 computer through an input port which is on the Speechlab board. The computer controls Speechlab by outputting control bytes to it.

In addition, I spoke with Lloyd Rice of Computalker Consultants who pointed out that knowing exact frequencies where energy peaked was more useful for discriminating certain sounds than was the average over a range, as measured by Speechlab (see Figure 2). Lloyd was able to predict accurately what sorts of sounds Speechlab would and would not be able to discriminate amongst. (It should be pointed out that the commercial units also measure energy over ranges.)

In addition to obtaining relatively limited information on an utterance, processing speed and memory size are fundamental bottlenecks. The commercial units use 16 bit minicomputers, not 8080's. The Speechlab demonstration program examines

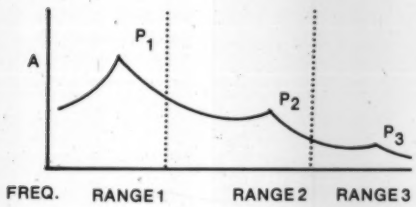

Figure 2
Hypothetical spectrum envelope of an utterance. Speechlab measures the area under the curve in its three frequency ranges. Commercial systems gather more information in that they look at 16 to 19 frequency ranges. Furthermore, the exact location of peak frequencies (P1, P2, P3) is useful information for distinguishing some sound; and it is not gathered by Speechlab.

only the first 160 milliseconds (16 samples at 10 millisecond intervals) after an utterance begins. This program has the "luxury" of a single speaker in a room with no background noise and the speaker responding on cue. In a factory, for example, where the system had to "listen" continuously for command words, processing time and memory requirements would be immense.*

As stated above, it could be that the demonstration program is poorly written and that the system is inherently capable of much better performance than it exhibits. I have not had time to experiment with program changes, and perhaps the Speechlab user's community will achieve improvements.

Lest this sound too negative, let's turn to the third reason why someone might buy a Speechlab: to learn.

Learning

This is where Speechlab shines! The documentation is excellent. There is one manual on assembly, checkout, and principles of operation which also serves as a programmer's reference and another "laboratory" manual with an introduction to linguistics, 35 experiments and well-documented source listings of all the software supplied with Speechlab.

The experiments in the laboratory manual are all quite clearly presented and interesting. The first 12 familiarize you with the system: how to get speech data into the computer, what the data looks like over time, the effects of noise, saturation levels, threshold setting (for silence versus utterance), linear versus logarithmic amplification, etc. The next group of six experiments teach you about the characteristics of speech, as measured in a linguistics laboratory. They guide the user through experiments similar to those run by linguistic researchers in the early 1960's. The remainder of the experiments deal with pattern recognition: with different metrics for closeness in the four dimensional Speechlab space, strategies for amplitude normalization, and strategies for sampling.

In short, this is an excellent educational product. Running these experiments is guaranteed to teach you a good deal about linguistics, pattern recognition and programming. It will require a fairly big-time commitment, but if you are interested in these subjects it will be time well spent.

It should be stressed that all of the Speechlab documentation is excellent, not just the experiments. The assembly manual is easily read and includes good material on testing, adjusting and trouble-shooting. The software is clearly written and well documented; and source listings are supplied.

Every manufacturer of personal computing equipment should be encouraged (pressured) to follow Heuristics' example in supporting Speechlab. My biggest gripe with the industry is that they have done a lousy job of educating their customers. A two hundred page manual will contain five pages on the principles of operation, geared to the expert, rather than 50 pages geared to the beginner. Software comes in object form — useless to learn from or to alter. We are left alienated from our machines and at the mercy of experts. Thanks to Heuristics for being different. □

*A possible compromise for continuous monitoring would be to program the system to recognize a key signal, such as a sharp whistle or snapping of fingers on a continuous basis, to alert it to the fact that a meaningful command follows within a second or two.

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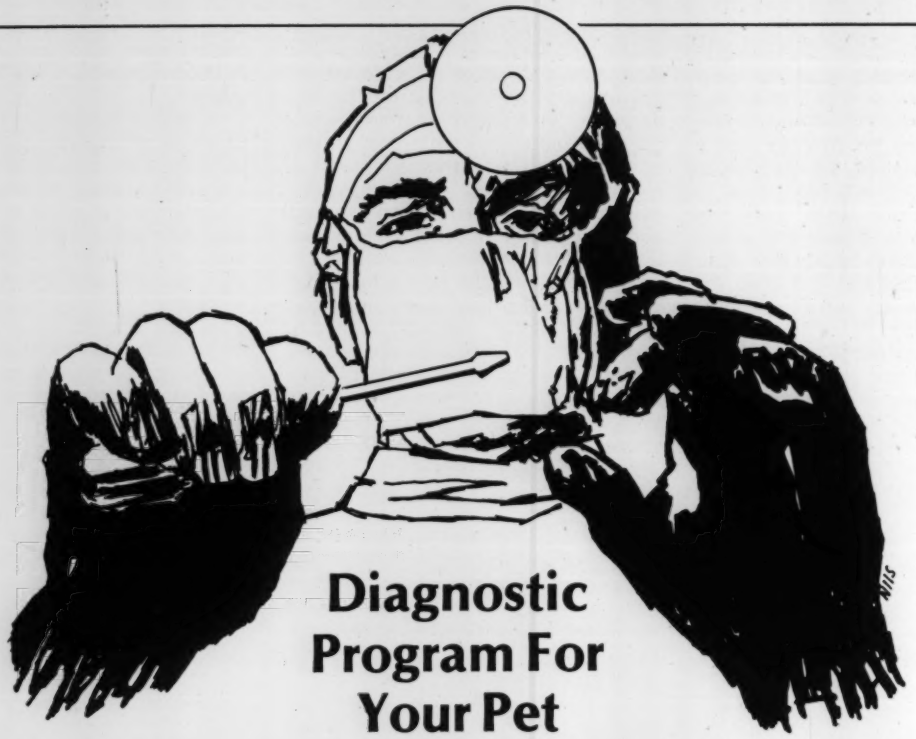


Diagnostic Program For Your Pet ...from Commodore

Sol Friedman

The availability of a Diagnostic Routine Package from Commodore for the PET computer is important news for PET owners and those contemplating the purchase of a home computer. The following information is provided to help you evaluate the package and decide whether it would be of value to you, as a PET owner. At $30 it seems to be a bargain and a must for every PET owner. I ordered the Diagnostic Package with some trepidation because, although I am somewhat familiar with the internal operation of home computers, I have never done any trouble-shooting of electronic equipment and wouldn't know where to begin. Furthermore, I do not have test equipment such as signal generators, oscilloscopes, etc. (although I do admit to owning a small volt-ohmeter). When I ordered the package, I really did not expect that I would be able to service the PET should it need service, but I felt that any information I might have on hand concerning the internal workings of the PET would prove invaluable to any technician who might service it. Certainly anything would be better than packing the unit and shipping it back to California, with possible damage to the equipment and the loss of time.

I was astonished to find how simple it would be to service the computer with nothing but Commodore's test package and a screwdriver. No instruments are needed, no special tools, or technical knowledge. It seems to me that the value of this package far exceeds the ability to test and repair the PET. There is also a great sense of reassurance in having the test routine. I have had difficulty with the computer many times. Eventually, having no alternative, I would discover that it was the program that was at fault, or the cassette tape, or a glitch in a command, or some other outside factor. With the test routine, you can assure yourself at any time that the equipment is working perfectly and after making that determination, get right to looking for the problem elsewhere. That's worth 30 bucks right there!

Sol Friedman & Associates, Industrial & Toy Design, 480 Birchwood Way, Ft. Lauderdale, FL 33326.

The $30 Package

The package consists of the following material:

1. A booklet, "Testing the Pet Computer," which describes all of the tests in detail and how to repair problems.
2. Two connectors with jumpers in place.
3. Component Cross Reference charts for the Display Assembly and the Main Logic Assembly.
4. Cassette of "PET Test Programs."
5. Pictorials and schematics for the display circuitry and main logic boards. Several versions of the main logic boards have been made by Commodore and schematics are included for each version.

The documentation is of professional quality and seems to be complete.

The package enables the user to test all RAM chips, the parity of ROM, the keyboard circuit, the TV display logic, the read/write of both cassette ports, the user port, and the IEEE 488 port.

The cassette contains the following programmed tests:

Program No.	Test
1,2,3.	ROM Test (for 011 ROM)
4,5.	4K Memory POKER
6,7.	8K Memory POKER
8,9.	4K Data Checker
10,11.	8K Data Checker
12,13.	Screen Alignment
*14,15.	ROM Test for 019 ROM

*Note: These test programs, num-

bers 14 and 15, are not listed in the booklet. My PET has the 019 ROM chip and ROM Test #1 indicated a defective ROM. Because my PET was working perfectly, I phoned Commodore and they told me that test numbers 1,2, and 3 are not valid for the 019, but to use tests numbered 14 or 15. They are on the cassette but were not listed in the booklet.

The Test Programs

Notice that the test programs are repeated on the tape (example, tests numbered 1,2, and 3 are identical). Commodore says that the reason they did this is that if you run the ROM test #1, for example, and you find a defective ROM and replace it, you should run the ROM test again to make sure there are not additional defective ROMs other than the one replaced. To save the trouble of rewinding the tape to repeat tests, several of each test program were recorded.

The Diagnostic Routine does not require the cassette. The two connectors supplied are placed as directed and a LED on the Logic board indicates test completion. The test runs automatically when the PET is turned on. The screen displays all of the PET characters and are checked visually by the user. Be sure to unplug the PET before working inside. Failure to do this can harm both you and your favorite computer. Upon completion, the connectors are removed and are not used in any of the other tests. No further access is required into the inside of the PET case.

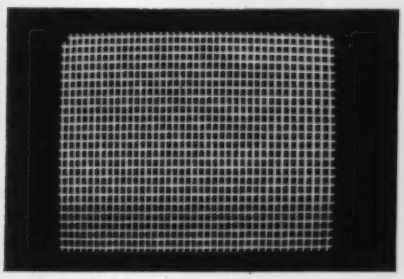
The ROM test is loaded into the PET from the cassette in the usual way. You will need to know which ROM you have in location H1 on the Main Logic Board. If you have 011, use ROM test #1,2 or 3. If you have 019 use program #14 or 15. To load 14 or 15 type LOAD "014 ROM TEST." To repeat, this information is not contained in the material sent by Commodore, so keep this article to remind you when you get the package. To determine which ROM you have, you must open the PET and look in the rear, right side of the Logic board, location H1. The board is clearly marked. The letters designate the row, and the numbers designate the column, running from right to left, along the nearest edge of the board. The ROM test will indicate a defective ROM, and which one needs replacement. Note: When completing these tests, it is necessary to turn off the computer to regain keyboard control.

The Memory test-RAM, as before, is loaded from the cassette, using either the 4K or 8K program. The program runs about 17 minutes and if there is a problem, will indicate the defective RAM, by row and column, plus more specific information about what is going on inside of the RAM.

Instructions are provided for removal of the Main Logic Board should that become necessary.

The Cassette test (Data Checker) describes the testing of both the built-in and second cassettes. The tape deck head should be cleaned and demagnetized, if you are having a problem with your cassette-loaded programs. This is the easiest repair you can make and the most common defect. It is a good idea to make it a habit to type "? PEEK(630), ST" after loading a program. The display will show two numbers which represent any error in the loading. Ideally both numbers should be zero, or as close to zero as possible. If you are consistently getting numbers much above zero you have a problem. The PEEK number represents the amount of data drop-out times 2, and the second number (ST) the status word which should be zero.

The Screen Alignment test creates three different patterns on the screen so that you can see whether the display is tilted, or if you are losing the bottom or top line. In case of misalignment, methods are clearly shown for correcting the defects. If you are not used to working around Video circuitry, I would strongly recommend that you do not open the back of the picture tube case. According to Commodore, the circuit uses 10,000 volts and, unless you know exactly what you are doing and where the dangerous voltages are, you can get badly hurt. Such high voltages can easily be fatal if contacted. If you can live with a slight misalignment, fine. If it is so bad that it needs correction, call a TV repairman, and show him the pictures and information contained in the booklet, and he should be able to fix the problem easily. Note that it is also easy to damage or break the CRT (TV) tube if you are not familiar with its construction.



One of PET diagnostic routine displays - screen alignment test. (Photo by Alan Friedman).

The Keyboard test is simply a matter of checking each key for sticking and for the display of the related characters on the screen. There are also a couple of Poke statements to verify other capabilities of the keyboard.

A few tests I was able to perform with the diagnostic package indicates that they work as advertised. Upon receiving the package I began the tests and almost immediately ran into trouble! This shocked me because my PET has functioned perfectly from the moment I unpacked it until that moment. The ROM test indicated that ROM #H1 was malfunctioning! I called Commodore and in our discussion they mentioned that this could happen if H1 was 019 ROM instead of the 011 ROM. That turned out to be the solution. As I mentioned earlier, there are two unlisted programs (#14 and 15) on the cassette for those PETs that have 019 ROMs. To load either program type-LOAD "019 ROM TEST." Use spaces as shown.

To simulate trouble, I tried removing RAM at location I-3. The display on the screen showed a problem with I-6.

A phone call to Rick Lehr at Commodore Customer Service turned up another factor not in the booklet. If your RAM chips are #2114 instead of 6550, then the numbers along the edge of the main logic board are in reversed order. If you have no difficulty with your RAM ICs then forget it. If you ever do, then the screen display number must be changed so that if the display shows number 1, the actual location is 8, number 2 displayed is located at 7, 3 is 6, 4 is 5, 5 is 4, etc. Thus I-3 displayed is located at I-6. It is important that you enter this information in your booklet in chapter III, under Memory Test, as a reminder (so you do not replace and discard a perfectly good chip!)

Summary

As good as the Diagnostic Routine is, it still can't do everything. There are the many resistors, capacitors, diodes and other components that can fail. If you turn on your PET and nothing happens, don't forget to see if it's plugged in, silly as that sounds. Next, remember that there is a fuse in the rear panel, check that next. If that's not the cause and all else fails, then do what I do.... PANIC! □

Super-Sort by Micro-Pro International

Eric VanHorn

Suppose you want to sort and merge ten different files in alphabetical order by zip code and a reference code, with variable length records in Binary Coded Decimal, and you want to do it in less than five minutes. That is exactly the kind of miserable job that can be done with Micro-Pro's Super-Sort. It is simple enough to handle mundane tasks like sorting a large mailing list by zip code; and, sophisticated enough that professional programmers will want to use it as a subroutine in custom software.

Super-Sort runs under the CP/M operating system and is available in three versions. We have been running Version I, which includes all the available options and is relocatable to run in FORTRAN, COBOL and BASIC. (it is in machine code, so it is independent of the programming language.) Version II includes all the capabilities of Version I and is not relocatable, according to Micro-Pro, but it should be possible to "CHAIN" to Version II if you want to use it in custom software. Version III does not have the SELECT/EXCLUDE command discussed later. Prices for the three different versions are $250.00, $200.00 and $150.00 respectively.

System Considerations

Although Super-Sort will run in a 24K, single drive CP/M system, this configuration will limit the versatility and performance of the package. A minimum memory size will reduce the speed of the sort as the processing is done in all the available memory. And, unless the file is very small you will have to use the TAGSORT option. TAGSORT is not a command as much as a method of handling work file space. Whenever a sort program processes a file larger than the available user memory, it creates work files which are later merged to write the output file. The space reserved for work files, particularly in a single drive system, reduces the maximum size of the input file. For example, in the case of Super-Sort, if the work file is as large as the input file, only one-third of a disk can be sorted at one time (one-third work space, one-third input, and one-third output). TAGSORT reduces the disk work space so larger amounts of data can be run. This does, however, further reduce sorting speed. A dual drive system solves this problem by using one drive for work space and the second drive for both the input and output files. (Disks in the second drive can be changed before writing the output file, and this way a full disk can be sorted.) For the ultimate in speed and versatility a 48K dual drive system is recommended.

Getting Started With Super-Sort

Super-Sort is loaded from the disk by simply entering "SORT." The Micro-Pro header is printed and the SORT prompt, an asterisk (*), is given.

The first four commands might be called the housekeepers. They tell Super-Sort on what drives certain things will happen and specify the file names. These commands are SORT-FILE(S), OUTPUT-FILE, MERGE-FILES and WORK-DRIVE. Standard CP/M nomenclature is used, simplifying input. SORT-FILE(S) indicates the input file name(s) and drive locations. Optional record numbers can be entered in parentheses to give a range of record numbers to be selected from a given input file. This allows a crude record selection in the SORT-FILE(S) command. (More sophisticated records selection is done by the SELECT/EXCLUDE option discussed below.) Up to thirty-two input files can be sorted, down to one output file on one run.

OUTPUT-FILE names the output file, assigns the disk on which it will be written and can indicate whether or not you want to change disks. This allows the processing of an entire disk in one operation. A /C after the file name invokes the disk change option.

MERGE-FILES is a command which will probably not be used frequently. It allows the merging of input data before sorting. Where it is useful is when TAGSORT is invoked. Since TAGSORT can only accept one input per run, MERGE-FILES will consolidate several files before TAGSORT takes over. The last command in this category, WORK-DRIVE, simply indicates on which drive work space is available. These temporary areas will be erased when no longer needed.

What does this look like in practice? Suppose we have three input files. Record numbers 200 to 450 will be extracted from RETAIL.TXT, all inputs are on drive B, drive A will be the work drive and output will go to drive B after changing disks. The command syntax is as follows:

```
* SORT-FILES = B:RETAIL.TXT (200-450),
  B:DEALER.TXT, B:EXPORT.TXT
* WORK-DRIVE = A:
* OUTPUT-FILE = B:NEWFILE.TXT /C
```

Record Types and Sort Specs

The next three commands tell how the records are structured, what type of sorting to do, and, optionally, which records Super-Sort will select from a given file. These commands are INPUT-ATTRIBUTES, KEY and SELECT/EXCLUDE.

INPUT-ATTRIBUTES sets the parameters for record organization. In most cases, this simply means enter-

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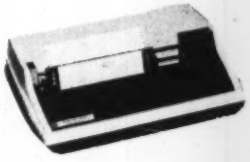

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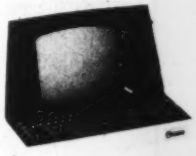

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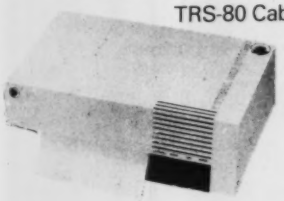

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Super-Sort, con't....

ing the fixed record length in number of characters. (Record lengths of up to 2048 characters are acceptable.) However, Super-Sort will handle variable length records, if a carriage return is used as an end-of-record delimiter. This is an extremely powerful capability, particularly when used with custom software. File entry programs generally use fixed length fields and records, limiting your entries to a certain number of characters per line. Almost everyone has seen computer mailing lists with abbreviated entries like:

```
R SMITH/UMINN
DEPT BIO/PHYSIC
2411 MRKT PL BLVD
ST PAUL, MN 00000
```

Even though this may be delivered, it is a sloppy way of using a tool as powerful as a computer. It is not only a nuisance trying to decide how certain entries should be abbreviated, but much time can be wasted counting letters and determining whether or not a name (or address, etc.) will fit on a line. Carriage return delimited records allow record lengths to stretch or contract depending on the amount of data, not the requirements of the computer. This also allows the reclaiming of unused disk space. Fixed length records pad unused space with blanks. This practice becomes unnecessary with a compressable, variable length format, possibly increasing the number of records that can be written to a single disk.

To use the INPUT-ATTRIBUTES command, the record length is entered followed by the specification for FIXED or CR-DELIMITED (carriage return) records. FIXED can be deleted as Super-Sort assumes records are of fixed size unless told otherwise. It appears that in variable length format the record length is an approximate figure, but the manual is unclear on this point.

The KEY command controls the sort process. In its simplest form, KEY determines the start and end location of the characters to be sorted (if sorting by character location), the field number and number of characters (if sorting by field location), and whether to sort in ascending or descending order. Numeric or ASCII format can also be indicated. Sorting by field location is a convenient feature. If the fields within a file are delimited by commas (which is not always the case), Super-Sort is smart enough to count these comma delimiters and find a certain number field. This can be an extension of variable record lengths, allowing fields to be of variable length also. Suppose, for example, in a variable length format that the name line has increased a record size. Obviously, the zip code is no longer in the same character position it was in the previous entry. But the field number will still be the same. (In our mailing list this is field 6, following the name, two address lines, city and state.) And for lazy people like me, it is certainly easier to count the number of fields than it is to count 120 or so characters (losing count several times, naturally) just to find out where the zip code is. Super-Sort knows you are giving it a field number rather than a character position when a "#" sign is used before the number.

The KEY command also controls special functions like Binary Coded Decimal files, upper and lower case translation, signed binary (two's complement) format, ignoring the high order bit in each byte, etc. Most users will never have the opportunity to use variations like this (with the exception of upper and lower case translation), particularly because these non-standard formats can be cumbersome in floating point BASIC. (As a matter of fact, I searched the manual and could not find any specific references to doing such work in floating point BASIC.) If your application falls into this category, I strongly suggest you buy the manual first and see if your specific situation is covered. In COBOL, FORTRAN or assembler the above circumstances are much easier to handle. At any rate, this gives you an idea of the range and versatility of Super-Sort.

SELECT/EXCLUDE, which is actually two separate commands, is used to perform record selection. The type of record selection available in the SORT-FILE(S) statement assumes, to some extent, that the file is in some order already, a case which is probably unlikely. (After all, what does a sort program do?) SELECT/EXCLUDE allows the selection or exclusion of specific records for sorting purposes. Suppose it is desired to extract all the names beginning with "A" in Arkansas or the retailers (by reference code) in Plainfield, Vermont. These can be selected exclusively for the sort. Or you can EXCLUDE something like all the TDL dealers in Priceton, NJ. (Something which I understand has already been done nationwide...)

Building on our previous example, we can sort by zip code (field #6, the first five characters) in ascending order, fixed length records that are 138 characters long by adding to our command list the following:

```
* INPUT-ATTRIBUTES = 138
* KEY = #6, 5, ASCENDING
```

Message Features and Command Files

There is one further statement, PRINT-LEVEL, which does not affect the sorting process (except, perhaps, to slow it down a little.) PRINT-LEVEL sets the number of messages Super-Sort will print during a run, reporting such things as when sorting is being done, files are being merged or written, the number of input records, sort runs and/or merges, how much work space is used, etc. There are five different message levels, 1 through 5, with one being the fewest number. The system defaults to level one (meaning a PRINT-LEVEL command need not be entered), but PRINT-LEVEL becomes very useful when there is a problem with a particular file. Suppose ten input files are being sorted, using all kinds of record selection and crazy formats and suddenly BOOM! CRASH!, the program run ends and you have no idea what happened. If the run is repeated, using PRINT-LEVEL 5, Super-Sort will give information on what is being done when the crash occurs.

Once you have used Super-Sort for a while, there are a number of convenience features which speed command entry. There is an abbreviated format for each entry (i.e., I 138 is the same as INPUT-ATTRIBUTES = 138, FIXED), and all program statements can be entered on one line (like multiple statement lines in Microsoft BASIC). In addition, if the same type of sorting is done often, a command file can be written which contains all the commands for a given run. I used the CP/M Editor to create command files, entering program statements in the editor the same way they would normally be given under Super-Sort. Now, once Super-Sort has been loaded, I simply enter CFILE = (for command file) and the name of the appropriate text file. Taking this one step further, it is possible to load SORT and execute the command file on one line, as in:

```
A:SORT CFILE = B:SORTZIP.TXT
```

This will automatically load Super-Sort from drive A, get the necessary commands from the text file SORTZIP on drive B, and run.

Speed, Documentation and Support

Micro-Pro has made a number of claims about the speed of Super-Sort, so naturally I have been asked ques-

Super-Sort, con't....

tions about it. But whatever Micro-Pro is saying, believe it. This is the fastest, and one of the finest, program I have seen. Generally speed is overrated as a software criteria, but two areas where speed is important are in long, hard-copy printouts, where 300 BAUD printers can drive you crazy, and general file maintenance functions like sorting. We have one sort program which takes an hour and twenty minutes to do a thousand records, a function Super-Sort can handle in about two minutes. Even given the advantages of using a computer for business purposes, wasted time like this can be extremely costly. Naturally the speed at which Super-Sort works depends on file size and organization, available memory, etc., but you will not be disappointed with its efficiency.

The documentation, although it is not packaged very well, is readable and complete. The manual is divided into two sections, one for users and the other for programmers. This helps avoid wading through pages of technical data when all that is needed is simple syntax. The programmer's section has machine code listings and more than you ever wanted to know about Super-Sort. It is unusual to find documentation that is simple enough for the first time user, yet contains all the technical information that might be needed.

If it is not already obvious, I am extremely impressed with Super-Sort. This is the Cadillac of sort programs. In addition, Micro-Pro backs up its products. If you do have a problem, they will not crawl into a hole and make you keep calling back for weeks to get an answer. (In fact, even though we have had no problems, Micro-Pro spent three days trying to call me because they heard we were.) If I have wet your appetite, you can reach Micro-Pro at 1299 4th Street in San Rafael, 94901, (415) 457-8990. □

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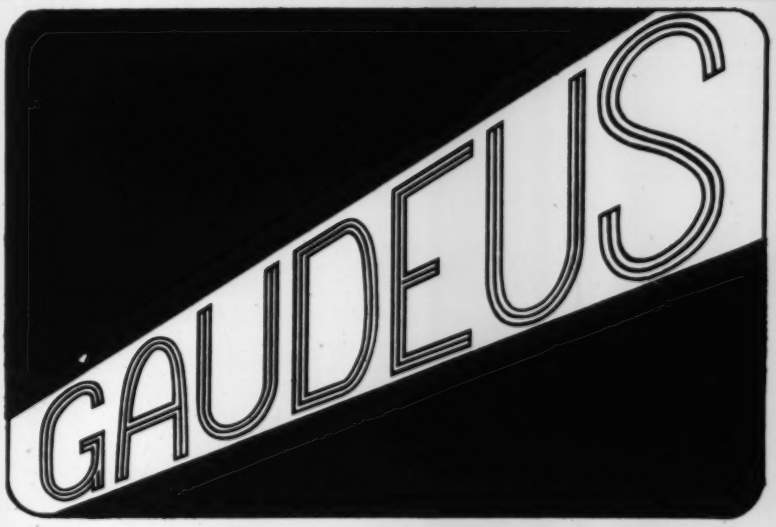

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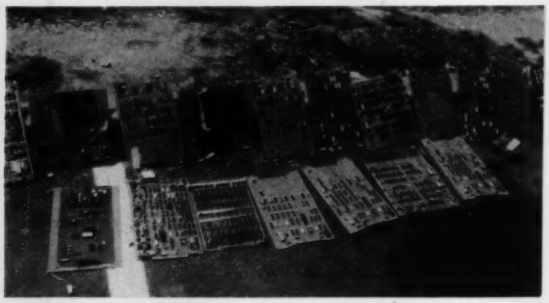

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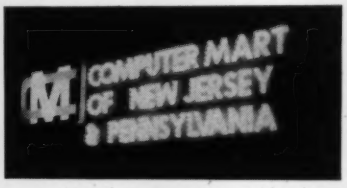

Photos by David Ahl

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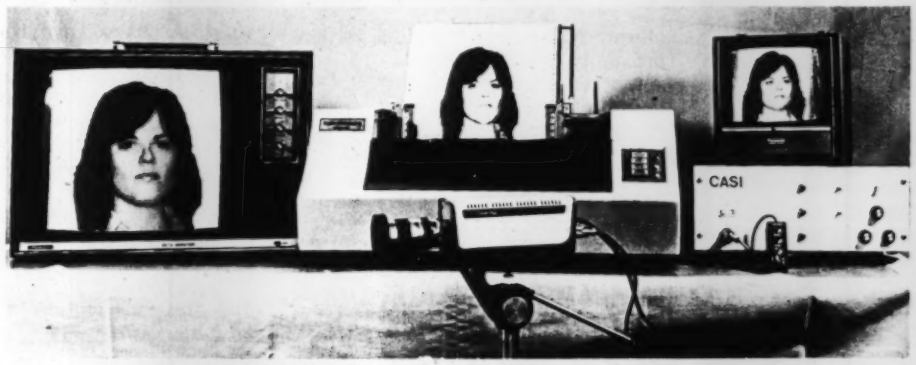

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Educational Use of the OSI 1P

Henry A. Kuska

The Fall of 1978 brought another price breakthrough in the field of microcomputers. Ohio Scientific announced a BASIC in ROM system with keyboard for $349. The general characteristics of this system, the Challenger 1P, were reviewed by Randy Heuer.[1] In this article I would like to share some of our experiences in using this microcomputer in an 8th grade computer course.

The $349 price was the primary reason for the decision to get a microcomputer at this time. This cost is at the level of other audio-visual equipment costs. The required television set and tape recorder were already available. A flea market TV game was used as a RF converter. The mathematics workbook[2] used in the 8th grade contained a chapter on computers and programming in BASIC so only a minimum of extra instructional materials were needed. The course was offered as one of the optional 8-week (one and a half hours per week) short courses available to the 8th grade students.

Although becoming familiar with BASIC and computers is the obvious goal of this course, a second goal as important, if not more important, is to provide the students with mental exercises that will assist them in developing the ability to think at the formal operational level.[3] The workbook fits nicely in this plan as it places considerable emphasis on analyzing a problem and setting up the steps required to solve the problem (i.e., flowcharting). As an example it asks the student to set up a flowchart for "how to eat a hamburger."

A preliminary version of the OSI BASIC Tutor program was used. It consisted of six lessons on cassette tape. A typical lesson consists of an explanation of a point, some examples, and then a user-interactive quiz with explanations of why the incorrect answers are incorrect. The tapes include frequent user controlled pauses which were used by the instructor to comment on the material, give extra examples on the blackboard, etc. Used in this way the tapes were adequate; however, I feel they would not be satisfactory as the only introduction to BASIC. The lessons were viewed by the class as a group on a normal 23 inch television set.

The large character size which Randy Heuer[1] felt was a disadvantage turns out to be an advantage for

classroom viewing. The close vertical proximity of the 24 line by 24 character display does result in a rather cluttered screen. Mr. Heuer suggests that programs be written with double space instructions. This is not necessary as the computer has a feature[4] which allows one to switch to an effective 12 by 24 display. This is accomplished by including a POKE 15,0 statement at the beginning of the program (POKE 15,72 returns the 24 x 24 display). In this mode a program statement of more than 24 characters and less than 73 characters will appear as single spaced lines on the screen, but a double space will automatically be put between statements. It appears that the class's attention is better kept by also using the slow character - by - character (typewriter-like) display possible by using POKE 517,255 (POKE 517,0 returns to the normal fast display).[5] From our experience in this course it appears that the 1P will be useful as a pseudo-video tape text preparer and playback unit for television instruction in general.

When not in use in a formal course, the computer can be used as a tutor for remedial work. The 8K BASIC contains all of the common statements needed for this purpose except the RANDOMIZE one. This is a serious omission as the random number generator will always give the same sequence of numbers. Fortunately the RANDOMIZE statement can be simulated by calling the following subroutine at the beginning of a program (or when a pause is needed).

```
500 PRINT "Press the space bar to continue."
501 POKE 530,1
502 POKE 57088,253
503 A=RND(1):REM,A is a variable not otherwise
    used in the program
504 IF PEEK(57088)=239 THEN POKE 530,0:RETURN
505 GOTO 503
```

The computer can also be used as a calculator with advanced math functions by the use of an "immediate" mode. For example, to obtain the square root of twelve the student would type ? SQR(12). The immediate mode will handle any combination of math operations, for example,
? ((7/9) + SQR (777)) / (3 + 6^2)
would be handled in one statement.

A possible long term problem is that the keys are attached directly to and supported by the printed circuit board. Some of the students use considerable force when typing! A more immediate problem is the location of the Break Key next to the Return Key. For education use, I suggest that the Break Key be disconnected and a Break switch be installed in a more remote location. The unit runs without a cooling fan and therefore can be used in locations where the noise of a fan cooled unit would be distracting. The keyboard is reasonably quiet. □

Henry A. Kuska, Dept. of Chemistry, University of Akron, Akron, OH 44325.

FOOTNOTES

1. R. Heuer, **Creative Computing**, 5, 120 (1979).
2. M. Hatzo and M.A. Horrigan, **New Ways In Numbers**, D.C. Heath Co., Lexington, Mass., 1974.
3. The formal operational level is the adult level of reasoning as described by the psychologist, Jean Piaget. This general area is now described by what is called a cognitive-skills approach to teaching. See, for example, A Whimbey and L.S. Whimbey, **Intelligence Can Be Taught**, Dutton, New York, 1975 (Also Bantam, 1976).
4. In fairness to Mr. Heuer I should point out that this feature is not in the preliminary OSI documentation. It was discovered by PEEKing into page 1 of the operating system. The same POKE works on the Challenger II. I have notified OSI.
5. POKE 518, 0 to 255 also affects the print-out rate (0 is the fastest, 255 is the slowest). However, POKE 517,255 is approximately 7% slower than POKE 518,255. I would like to thank Rod Kapela for pointing out the POKE 518 behavior.

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Butte, MT

Acutronics
Summit, NJ

Beacon Computer
Metuchen, NJ

High Technology
Oklahoma City, OK

The Electronics Place
Pittsburgh, PA

Gallion Data System
Mechanicsburg, PA

G.Y.C. Company
York, PA

International Data
Solebury, PA

The Computer Shop
San Antonio, TX

Barbara Rush
Mesquite, TX

Small Computer Products
Austin, TX

Southwest Electronics
Melbourn, Australia

Sontron Instruments
Victoria, Australia

The Computer Circuit
Ontario, Canada

Strumech Engineering
Staffordshire, England

MRL Building
Delft, Holland & Belgium

Hauker HF
Reykjavid, Iceland

Electricity Supply Board
Ireland

Digito Systemas S.A.
Monterrey, Mexico

ECONZ
New Zealand

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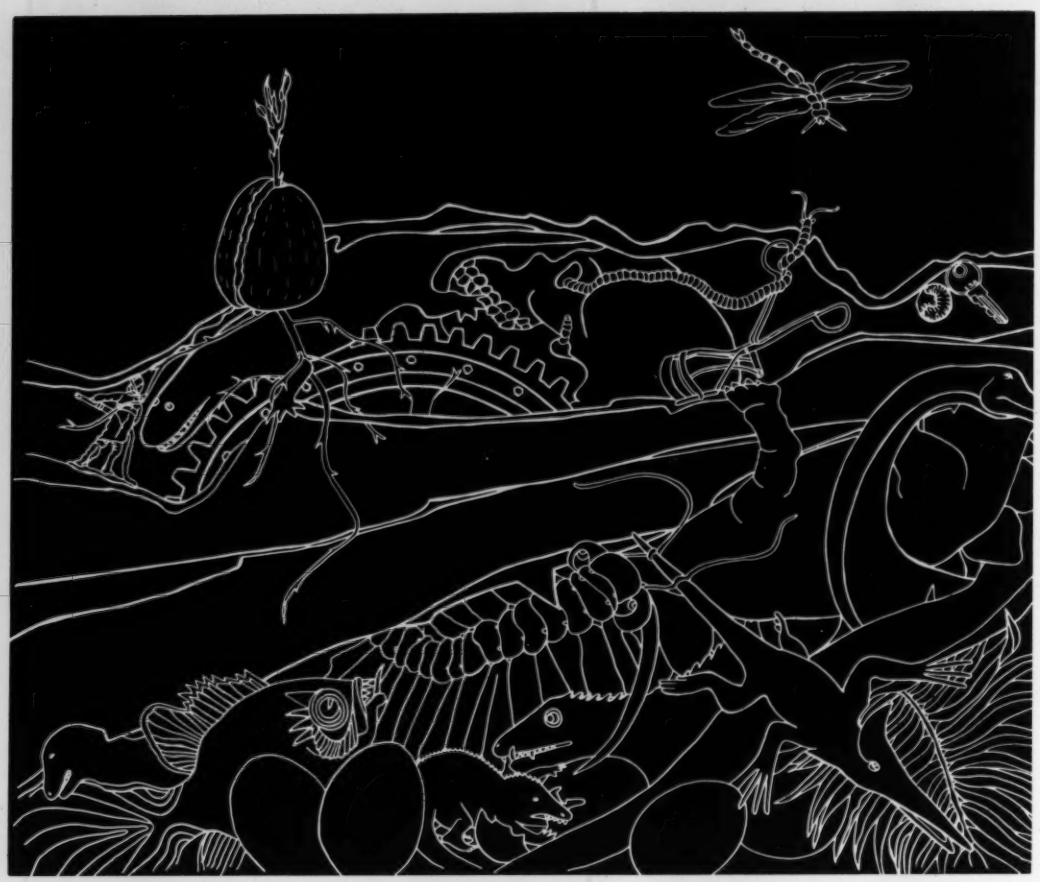

STERL: Computer Simulation of Pest Control Methods

Ann Corrigan

The Pest-Control Dilemma

"Ecology" is a popular word today. While there are probably a few who would not yet assign any great importance to problems of an ecological nature, most have accepted the dogma that humanity had better start paying attention to the impact we are having on the environment surrounding us. Beginning with the publication of Rachel Carson's **Silent Spring** in 1962, evidence has been piling up that we have been doing damage to the world's ecosystems for millenia, that the degree and impacts of this damage have been accumulating, and that the earth is not capable of supporting an unlimited amount of damage.

One of the major ecologically sensitive problem areas is how to control species that interfere with man's activities (otherwise known as pests — sometimes the earth must think man is a pest!) without sending waves of undesirable side effects into the environment. The pesticide DDT (Dichloro-Diphenyl-Trichloride) and its relatives have come under a lot of fire from environmentalists. These organic pesticides, developed during World War II, were highly regarded and widely used because they were relatively inexpensive and very effective, especially since they did not break down easily and so remained in the environment for a long time doing away with nasty pests. Unfortunately, these pesticides' long lives meant that not only did they destroy pests for a long time, but they also stayed around to accumulate in non-harmful species. Because chemicals concentrate as they pass up the food chain, DDT and similar pesticides can accumulate in lethal quantities in those animals that feed high on the food chain (humans are among these animals). Also, the long-term effectiveness of pesticides has been called into question because rapidly reproducing species such as insects can mutate fast enough to produce

strains that are resistant to specific pesticides.

But just banning pesticides is not enough. Some very serious problems, such as malaria, against which these pesticides were developed, still remain. Other methods of control must be developed. Recent efforts have concentrated on "biological control" — utilizing a pest's natural enemies or other means which enlist the forces of stability inherent in ecological systems to control pest outbreaks. One of these methods is the release of sterile males of a pest species into the environment of an outbreak. The sterile males compete with natural fertile males for females, thereby interfering with reproduction and lowering the size of the next generation. This method was pioneered by Dr. Edward Knipling and has been proven extremely successful in controlling several species of pests, including the one it was first employed against: the screw-worm fly, one of the major destroyers of livestock in the southern U.S. (For other species of insect pests, however, it has been found difficult to implement this technique successfully. The malaria carrying mosquito is an example; despite several attempts to employ more ecologically sound methods of malaria control, DDT remains widely used because of its effectiveness and relatively low cost. Examples such as this illustrate how difficult it can be to select pest-control strategies because of conflicting requirements of health, economics, ecology, etc.)

Unfortunately, it is not possible for everyone to run out and experiment with pest control in the real world.

STERL: Simulating Pest-Control Efforts

Much can be learned about pest-control and the ecological dilemmas surrounding it by reading about past attempts to control harmful species, their negative ecological impacts, and recent revisions of pest control programs to bring them more in line with environmental protection. Reading about past history, however, while useful, cannot provide the deep understanding that comes with active observation and investigation. Unfortunately, it is not possible for everyone to run out and experiment with pest control in the real world. Not considering the time and resource constraints, such a project would undoubtably wreak havoc on an already overburdened environment! Computer simulation models, on the other hand, allow active, repeated investigation within time and resource constraints and without the real-world impacts. As I hope to illustrate below, they can also be challenging and a lot of fun!

The STERL computer model is one of the Huntington II series of simulation models which were designed mainly for secondary education. These programs were motivated by a desire to provide students with interactive access to solving problems that are related to important real-world problems and that are not usually accessible to investigation by students. Originally developed for Digital Equipment Corporation minicomputers, these models are now being converted for use on several popular microcomputers. The version of STERL described here was developed by Creative Computing Software for the Radio Shack TRS-80 (Level II, 16K machine). Microcomputers are especially suited for the Huntington II models because of their general graphics capabilities which add interest and excitement to the runs and because these computers are much more affordable by smaller schools and even individual users.

The object of STERL is to eliminate an initial population of 1 million adult male screw-worm flies (it is assumed that there are also 1 million adult female flies) in a 10,000 square mile area. Female screw-worm flies lay their eggs in the open wounds of animals, and when the larvae hatch they feed on the animal's flesh. This can kill even a full-grown animal in a matter of days. Annual livestock losses in the U.S. due to the screw-worm fly have been estimated at $40 million. Wildlife losses from this pest are not known. Users of STERL may employ a pesticide, release sterile males, or a combination of these two methods to control the flies. STERL calculates the number of normal (unsterilized) adult male flies in the area over a 75-day period and plots the results (see Fig. 1). Users' plans are evaluated according to how well they eliminated the flies, the amount of damage done to livestock in the area, the cost of the control program, and the environmental impact of the control effort.

"What If I Tried...."

Many different control strategies can be tried with STERL. Users specify which days pesticides are to be released into the area. Users also state which days sterile male flies are to be released, either by identifying individual days or by selecting blocks of days (e.g., day 10 to day 20, day 2 to day 75), and how many sterile flies are to be released on each day or for each block of days. Users can try using pesticides alone, releasing different numbers of sterile flies without using pesticides, using both pesticides and sterile fly releases at the same time, and using both methods but at different times and/or in different combinations. Users can continue their control strategy throughout the entire 75-day period or can stop control measures once the fly population has reached zero (and then see what happens). Because there are so many different combinations of control measures that can be used with STERL, with widely varying results, users are automatically encouraged to try new and different ways of controlling the fly population. The excitement and interest this stimulates certainly assists the user in gaining both a broad and a deep understanding of pest-control problems as modeled by STERL and should be welcome in the classroom by teachers and students alike. By availing themselves of the active investigation process encouraged by STERL, users gain knowledge not only of the specific problem area but also an understanding of modeling in general and an appreciation of science as an active process of inquiry.

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"How Well Did I Do?"

STERL graphs the results of the user's control plan by plotting the number of normal adult male flies over time. STERL plots each daily fly population as it is calculated; thus, the user is able to watch the results as they are slowly plotted (1 day every 1-2 seconds) on the video screen. This

STERL, con't....

slow graphing of results adds excitement and suspense; users tend to sit with their eyes glued to the screen, making appropriate noises and comments as the fly population first plunges then rises slowly, then drops again, etc. As the daily results are plotted, and if the user has elected to make heavy use of pesticides, comments appear at the bottom of the screen that sketch the impact of pesticide use (e.g., "A few poisoned birds have been found in your area."). Once the graph is complete, results

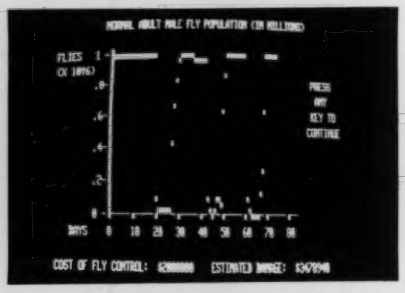


Figure 1: Results of pesticide application on days 20-26, 43-49, and 61-66. Cost of fly control $2.0 million; livestock damage $3.5 million.

are printed showing the total cost of the control effort (1¢ per fly released and $100,000 per pesticide application) and the total dollar damage done by any uncontrolled flies. The user is allowed to study the graph as long as he or she wishes, then a general evaluation of the user's control plan is presented. If the user successfully eliminated all the flies, the computer prints congratulations; otherwise, the final number of flies (on day 75) is printed. The environmental soundness of the control program is also evaluated (from "SUPER ENVIRONMENTALIST!!" to "YOU ARE BEING SUED BY ENVIRONMENTALISTS FOR YOUR HEAVY USE OF PESTICIDES!"). Finally, if all the flies were eliminated, the total cost of the program is printed and evaluated. After a few runs, it becomes readily apparent that pesticides are not only less environmentally safe than sterile fly releases but also much more costly.

Model Structure

Initially, the fly population of the area is 1 million normal male flies, distributed equally over each of the 17 days of adult life. One million is the maximum the area can support (called the "carrying capacity"). It is assumed that there is always an equal number of females present but population counting includes only the number of normal male flies.

Population size is calculated for each of the 75 days, according to the following sequence of events. First, all 17-day old adults, both normal and sterile, die. Next, new normal adults emerge from the pupal state, 13 days after the eggs are laid. If the user has requested sterile fly releases for that day, the flies are then released. The total population is then temporarily calculated to be equal to the population from the preceding day, plus newly emerging normal flies, plus newly added sterile flies, minus 17-day old sterile and normal flies.

This population value is then compared with the area's carrying capacity of one million flies. If the population exceeds 1 million, emigration occurs: flies leave the area in proportion to the distribution of normal to sterile flies. If there are less than 1 million flies, immigration of flies from outside the area occurs; the number of immigrating flies will be 10% of the difference between the carrying capacity and the current fly population. The populations of both emigrating and immigrating flies are distributed equally over all ages.

Next, if the user has requested pesticide application for that day, this occurs. The pesticide (which is **not** DDT) eliminates 90% of the adult fly population (steriles and normals are affected equally) on the day it is applied, but is ineffective after that day. The number of adult flies remaining is plotted and carried over to the next day.

The next event is egg-laying by the remaining 7-day old females. Each adult female is capable of laying 250 eggs. The total number of **fertile** eggs is determined by the relative proportions of normal males and steriles and by the lower "mating efficiency" of sterile males. Four sterile males are needed to compete successfully with one normal male because the sterilizing irradiation weakens these males and reduces their sex drive. Only a small percentage of the fertilized eggs reach adulthood. The exact percentage depends on the normal adult population in the area at that time, and is determined by a linear equation (1% survival rate with a 1 million population; 4% when the population is 100,000). This percentage times the number of fertile eggs gives the number of adult flies which emerge 13 days later.

Ten percent of the females will mate and deposit their eggs on livestock. It takes 10 females depositing eggs to kill one cow. It therefore takes 100 fertile females to kill one cow per month. Death of cattle results in a $200 loss per animal.

Sample Control Strategies

Experimenting with different control programs in STERL rapidly develops an understanding of the nature of pesticides and sterile fly releases as pest control methods, how well each method works alone, how the two methods interact when used together, and how to choose a control plan that is economical, effective and environmentally sound.

After a few runs, it becomes readily apparent that pesticides are not only less environmentally safe than sterile fly releases but also much more costly.

Possible results of trying to control the flies using pesticides alone are shown in Figure 1. No controls were used for the first 20 days, and the population remains at 1 million. Pesticides are then applied on days 20-26, 43-49, and 61-66. The results show a precipitate drop in population when pesticides are first applied, continued low population as pesticides are continued, but a rapid increase back to the carrying capacity as soon as pesticide applications are stopped. This is a poor strategy: not only are the flies not eliminated but $3.5 million in livestock damages are done at a total cost for the pesticides of $2 million. Users will find that even using pesticides every day will not totally eliminate the flies and will be extremely costly.

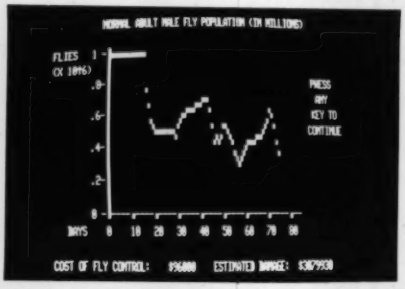


Figure 2: Results of releasing sterile male flies for two weeks on, two weeks off, etc. Cost of fly control $2.2 million; livestock damage $2.3 million.

Figure 2 shows sample results of using sterile flies alone. No control was used for the first 2 weeks, then a pattern was established of releasing 300,000 flies daily for 2 weeks on, then 2 weeks off, etc. A slow decline in the fly population is observed while flies are being released. The population rises when fly releases are halted, but the immediate and drastic jump in population seen when pesticides alone are used is not experienced with sterile fly releases. Also, the overall trend is one of slow decline — different from the apparent "starting-all-over-again" pattern seen when pesticides alone are used, then stopped, then resumed. Although better than strategy 1, this program still does not do the job and costs close to $4 million.

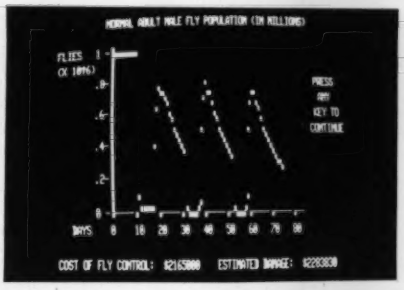


Figure 3: Results of sterile fly release from day 11 on combined with pesticides on days 11-17, 32-38, and 53-59. Cost of fly control $99,000; livestock damage $3.1 million.

Pesticide applications can be combined with sterile fly releases, but, as Figure 3 shows, not always with good results. In fact, the two methods can interfere with each other, since pesticides destroy sterile as well as normal males. The control plan used in Figure 3 included sterile fly releases (100,000 per day) from days 11-75 and pesticide applications on days 11-17, 32-38, and 53-59.

Models like STERL are not meant to replace the standard educational methods but rather to be used as complements to other classroom activities.

You may feel discouraged at this point, so I've included the results of a successful plan, shown in Figure 4. I'll let you figure out the inputs!

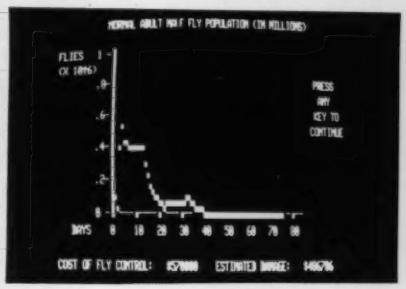


Figure 4: Results of a successful fly control plan. Cost of fly control $565,000; livestock damage $492,000.

STERL As An Educational Tool

Simulation programs like STERL are an excellent supplement to the standard educational tools and techniques. Besides providing access to topics not normally covered, or covered only briefly, simulation models let (in fact, encourage) the student to obtain knowledge actively, independently and according to a strategy the student actually develops. Students can ask their own "what if" questions, can design, carry out and see the results of their own control strategies. In addition to the general interest-raising effects of promoting active problem exploration, computer models using graphics and pointed, but mildly humorous, evaluative comments can give extra enjoyment to the learning environment. Learning becomes a game. Models like STERL are not meant to replace the standard educational methods but rather to be used as complements to other classroom activities. Experience with computer models can be combined with other methods in investigating a particular topic such as pest-control to deepen and enrich the learning experience; student experience with simulation games may even spur their interest in pursuing the subject further through literature, other types of experimentation, etc. Not only do models like STERL educate students in specific problems or areas, they also initiate students in the art of building and using models. Students can learn the importance of the assumptions on which the model is based, how these assumptions affect the results produced by the model and how closely these results match what would happen in the real world. More sophisticated students can play with changing model assumptions to discover their impact on the results. Lessons learned here apply not only to computer models but to any models, formal or informal, that are used to understand, predict or control the world. Finally, users of simulation models can develop and refine their ability to systematically investigate some process and, in general, come to understand science and learning as on-going, active processes of inquiry.

Huntington II Ecology Tape

The tape cassette, Ecology Simulations-1, contains four simulation programs, adapted from the Huntington II Project:

1. POP — Explore three population growth models.
2. STERL — Use pesticides vs. release of sterile males to control fly pest population.
3. TAG — Use "tagging-and-recovery" sampling technique to estimate the number of fish in a pond.
4. BUFFALO — Manage a buffalo herd to allow hunting while keeping buffalo from becoming extinct.

The tape complete with an extensive resource manual is available for $24.95 plus $1.00 shipping for the TRS-80 (Cat. No. CS-3201) and the Apple II (Cat. No. CS-4202 — available October). Write Creative Computing Software, P.O. Box 789-M, Morristown, N.J. 07960. □

About the Author

Ann Corrigan is responsible for developing new educational software at the Creative Computing Software Development Center. She has a BA in mathematics from Ohio State University and is currently in the PhD program at Rutgers University Institute for Cognitive Studies.

Illustration by Ellen Steinfeld.

©Creative Computing

"So you want to know what the chances are, of this cartoon being published!"

The World of Scouting and Computing

Paul E. Garrison

Getting young people turned onto computers can be a gratifying and challenging experience. The 40,000 computer merit badges earned by Scouts so far should only be a drop in the bucket.

Sometime late last year, a boy was called up in front of friends, relatives and peers to receive an unusual distinction. He became the 40,000th Boy Scout to earn the "Computers" merit badge.

The presentation included a signed card signifying his achievement, and a four-color embroidered patch about the size of a fifty-cent piece to sew on a uniform sleeve or merit badge sash.

According to records kept by the Statistical Service Department of the Scout organization, an average of over 5,000 boys have earned the computer badge during each of the past five years with the 40,000 mark reached around last December.

Exactly who received this honor will probably never be known. The recipient could have been from New York, California, Florida or Washington. Perhaps he is a boy you know or even helped in his quest for the badge.

According to records kept by the Statistical Service Department of the Scout organization, an average of over 5,000 boys have earned the computer badge during each of the past five years with the 40,000 mark reached around last December.

Scouts who earn the "computers" badge give a history of computers, explain the major parts of a computer system and describe four different uses of computers.

Paul Garrison, 8634 Rose Lane, Philadelphia, PA. 19136.

They tell of differences and uses of both analog and digital computers. The differences between special- and general-purpose machines are also described.

To the satisfaction of his adult counselor, the ambitious youngster, 11 years old or older, tells what a program is and how to set it up; how to differentiate between an assembler and a compiler; and defines a source and an object program.

Tying in computer skills with scouting lore, badge aspirants use a flowchart diagram to show the steps needed to set up a campsite. Some, as an option, prepare flowcharts to figure average attendance and dues paid at five troop meetings. Others chose to work out a simple arithmetic program using flowcharts.

They go on to explain four input/output devices for computers as well as the use of two of them in a system. The Hollerith code is described.

All badge candidates show how their name and address would be punched on a card. They then select six of ten terms to describe such as byte, console, microsecond and interrupt. In another exercise, they show an understanding of such terms as truncation, cybernetics, simulation and information retrieval.

A computer installation is visited and its workings studied. The responsibilities of the design engineer, customer engineer, programmer, analyst, operator and sales people in the computer field are explained.

Some counselors ask local scoutmasters for the opportunity to "sell their subject" at a troop meeting. Troops are often looking for such program material.

The "Computer" badge seekers are to read and describe information about computers secured from their local library from books recommended by the American Library Association's Advisory Committee to Scouting. Finally, jobs available in the computer field are discussed.

Many boys have recently found the opportunity to begin what may well be a life-long association with computers through the Scout merit badge program.

To qualify for the badge, the scout must appear before a volunteer adult called a merit badge counselor. This person can be a specialist in the computer field, a teacher, or a person familiar with computing techniques through business or hobby. No Scouting experience is necessary, but a desire to guide ambitious youngsters is appropriate. Interested adults contact local Scout council offices for specifics.

Some counselors ask local scoutmasters for the opportunity to "sell their subject" at a troop meeting. Troops are often looking for such program material. Computer badge counselors have been known to demonstrate basic techniques and uses of personal and business computing. Others have shown brief films on the subject.

Supplementing the help of the counselor is a "Computers" merit badge pamphlet, a 55-cent booklet that gives the requirements in detail and helpful suggestions. This illustrated publication was written by J.A.N. Lee.

Pamphlets are reprinted each year and requirements are updated regularly. They are found in many school and public libraries, local scout supply outlets, council offices or direct from the Supply Division, Boy Scouts of America, North Brunswick, NJ 08902. Revisions and improvements to the badge and pamphlet come from counselors as well as scouts themselves.

After meeting badge requirements to the satisfaction of his counselor,

THE SEARCH FOR A SMALL COMPUTER SYSTEM STARTS HERE

It's the 3rd Annual National Small Computer Show

New York Coliseum, August 23-26, 1979

presenting the state-of-the-art showcase for micro-and mini-systems technology and software. Here you can survey virtually all makes and models of small computers, whether your interest runs to a no-nonsense micro priced in the hundreds of dollars or a powerful mini costing $20,000 or more. They're all here.

The world of small computers is quite large, extending to business and professional offices, scientific research, medicine and bionics, education, the home and hobbyist, therapeutic applications for the handicapped, design and engineering. A full selection of lectures is presented to provide a grasp of small systems technology, so that you know what to consider when buying a computer or word processor. It's the first step in discovering what a system can really do for you!

NSCS lectures include sessions on system selection, computer languages, word processing functions, artificial intelligence, software applications, and a dozen more topics for people of all interests.

Plan now to attend. There will be about 30,000 square feet of exhibits, and more than 40 hours of lectures from which to choose. Registration fee is only $5.00 per day, including lectures.

LECTURES: (Program subject to change)

Thursday, August 23

- **1 p.m.** The Peril of Becoming a Machine-Oriented Business User
- **1 p.m.** Introduction to Small Business Systems
- **2 p.m.** Selecting a Word Processing System
- **2 p.m.** Distributed Data Processing
- **3 p.m.** Accounts Receivable/General Ledger/Accounts Payable
- **3 p.m.** Is There a Computer in Your Educational Future
- **4 p.m.** Mailing Lists: Load, Time and Cost
- **4 p.m.** Word Processing Systems in the Law Office
- **5 p.m.** Basic BASIC
- **5 p.m.** Achieving Quality Control in Word Processing

Friday, August 24

- **1 p.m.** The Peril of Becoming a Machine-Oriented Business User
- **1 p.m.** Introduction to Small Business Users
- **2 p.m.** Selecting a Word Processing System
- **2 p.m.** Distributed Data Processing
- **3 p.m.** Unassigned at press time
- **3 p.m.** How to Write a User-Oriented Program
- **4 p.m.** Efficient Expansion of a Small System
- **4 p.m.** Investment Analysis
- **5 p.m.** Accounts Receivable/General Ledger/Accounts Payable
- **5 p.m.** Exploiting the Apple/Dow Jones Computer Link

Saturday, August 25

- **11 a.m.** Introduction to Personal Computing
- **11 a.m.** Unassigned at press time
- **12 p.m.** Computer Music Update
- **12 p.m.** Unassigned at press time
- **1 p.m.** Introduction to PASCAL
- **1 p.m.** Computer Art Forms
- **2 p.m.** Household Applications
- **2 p.m.** Artificial Intelligence
- **3 p.m.** How to Write a User-Oriented Program
- **3 p.m.** Investment Analysis
- **4 p.m.** Basic BASIC
- **4 p.m.** Unassigned at press time

Sunday, August 26

- **11 a.m.** Introduction to Personal Computing
- **11 a.m.** Computer Music Update
- **12 p.m.** Household Applications
- **12 p.m.** Unassigned at press time
- **1 p.m.** Efficient Expansion of a Small System
- **1 p.m.** Computer Art Forms
- **2 p.m.** Unassigned at press time
- **2 p.m.** Unassigned at press time
- **3 p.m.** Microcomputers for the Handicapped: Update
- **3 p.m.** Exploiting the Apple/Dow Jones Computer Link
- **4 p.m.** Mailing Lists: Load, Time and Cost
- **4 p.m.** Introduction to PASCAL

REGISTRATION FOR AMERICA'S BIGGEST SMALL COMPUTER SHOW

Please register me for the 3rd Annual National Small Computer Show, Aug. 23-26, 1979.

NAME _____ BUSINESS TITLE (If Any) _____

COMPANY (If Any) _____ TELEPHONE _____

ADDRESS _____

_____ ZIP _____

(Check main interest)

- ☐ Banking/Insurance
- ☐ Business office
- ☐ Communications
- ☐ Educational
- ☐ Government
- ☐ Hobby
- ☐ Industrial/Manufacturing
- ☐ Military
- ☐ Professional
- ☐ Stock Brokerage
- ☐ Transportation
- ☐ Utility
- ☐ Wholesale/Retail
- ☐ Other _____

(Check main job function)

- ☐ Accountant
- ☐ Administrator (Business)
- ☐ Architect/Builder
- ☐ Art Director
- ☐ Banker
- ☐ Computer technician
- ☐ Consultant
- ☐ Controller
- ☐ Engineer
- ☐ Industrial Designer
- ☐ Lawyer/law office mgr.
- ☐ Marketing manager
- ☐ Medical doctor
- ☐ Medical technician
- ☐ Office manager
- ☐ Programmer
- ☐ Public Servant
- ☐ Research/Development
- ☐ Teacher
- ☐ DP manager
- ☐ WP manager
- ☐ WP operator
- ☐ Stock Broker
- ☐ Systems Analyst
- ☐ Student
- ☐ Other _____

☐ ONE DAY $5 ☐ TWO DAYS $10
☐ THREE DAYS $15 ☐ FOUR DAYS $20

Mail with payment of $5 for each day you wish to attend. Use one form per person. Registration badge will be sent by mail in early August. Check or money order only.

Mail prior to Aug. 10 to:
National Small Computer Show,
110 Charlotte Place,
Englewood Cliffs, N.J. 07632.

Scouting, con't....

the scout takes part in a "Court of Honor." This is a function where recent advancements are recognized. Earning the "Computers" badge is one of many challenging activities of Scouting, and only one of several badges the average scout will attain. Scouts, and their older members called Explorers, have more than 120 different merit badge subjects from which to select, covering areas of interest from agriculture to woodwork.

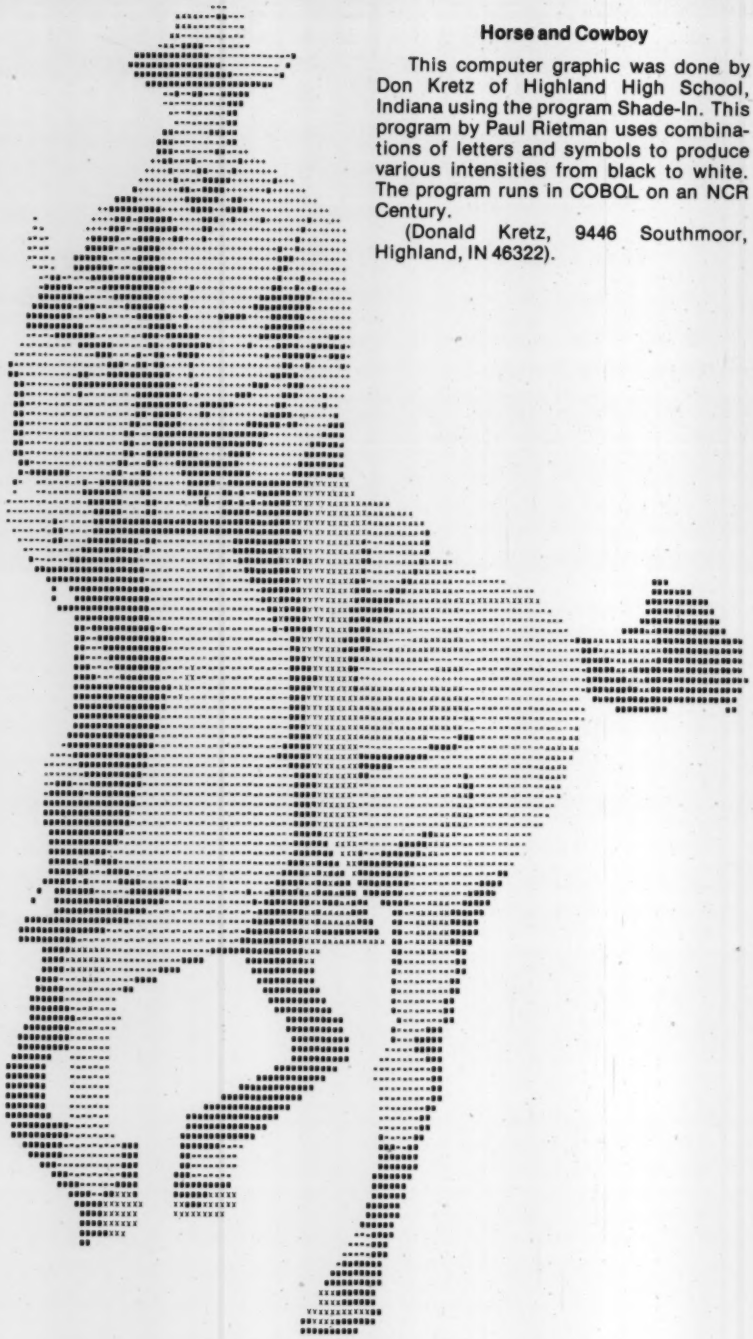
Badges such as camping, swimming, and cooking go back to origins in the early 1900's. Other badges like blacksmithing, pathfinding and stalking are now discontinued. New subjects were introduced, such as "Computers" in 1968, "Consumer Buying" in 1975, and "Energy" in 1976.

Many boys have recently found the opportunity to begin what may well be a life-long association with computers through the Scout merit badge program. Millions of scouts have been trained to "be prepared" since the BSA began in 1910. By 1978, over 40,000 have shown they are also well prepared to utilize the advantages of computers in personal and business life.

You can help. □

TROUTMAN'S PROGRAMMING POSTULATES:

1. If a test installation functions perfectly, all subsequent systems will malfunction.
2. Not until a program has been in production for at least six months will the most harmful error be discovered.
3. Job control cards that positively cannot be arranged in improper order will be.
4. Interchangeable tapes won't.
5. If the input editor has been designed to reject all bad input, an ingenious idiot will discover a method to get bad data past it.
6. Profanity is the one language all programmers know best.



Horse and Cowboy

This computer graphic was done by Don Kretz of Highland High School, Indiana using the program Shade-In. This program by Paul Rietman uses combinations of letters and symbols to produce various intensities from black to white. The program runs in COBOL on an NCR Century.

(Donald Kretz, 9446 Southmoor, Highland, IN 46322).

There are over 50,000 computers in the U. S. today, all equipped with printers whose average capacity is, say, 200 lines/minute. Run those 60 minutes/hour, 8 hours a day, 360 days a year and you have printed over one *trillion* lines of output.

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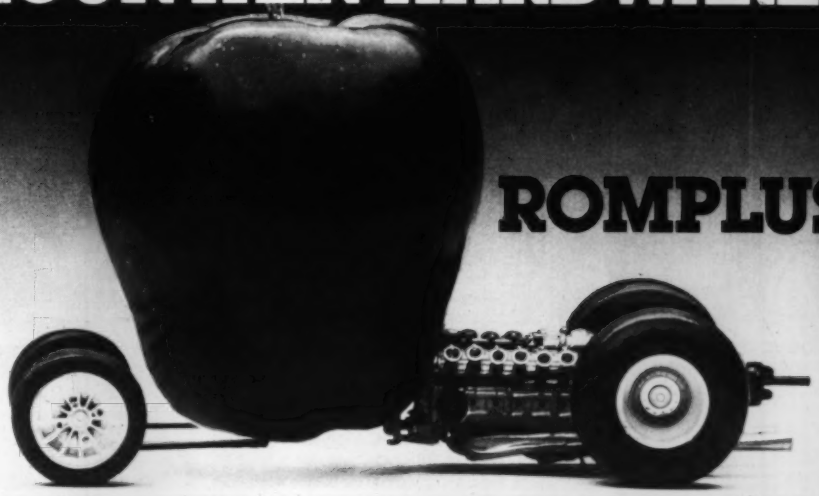

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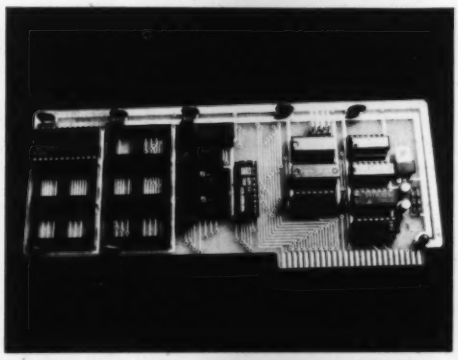

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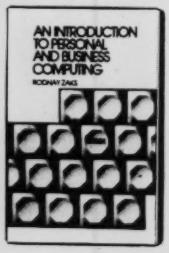

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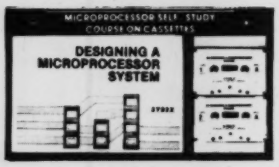

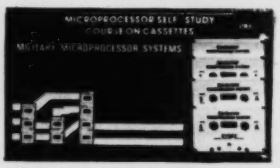

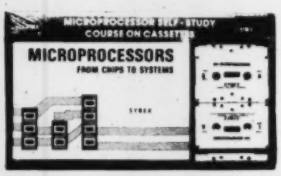

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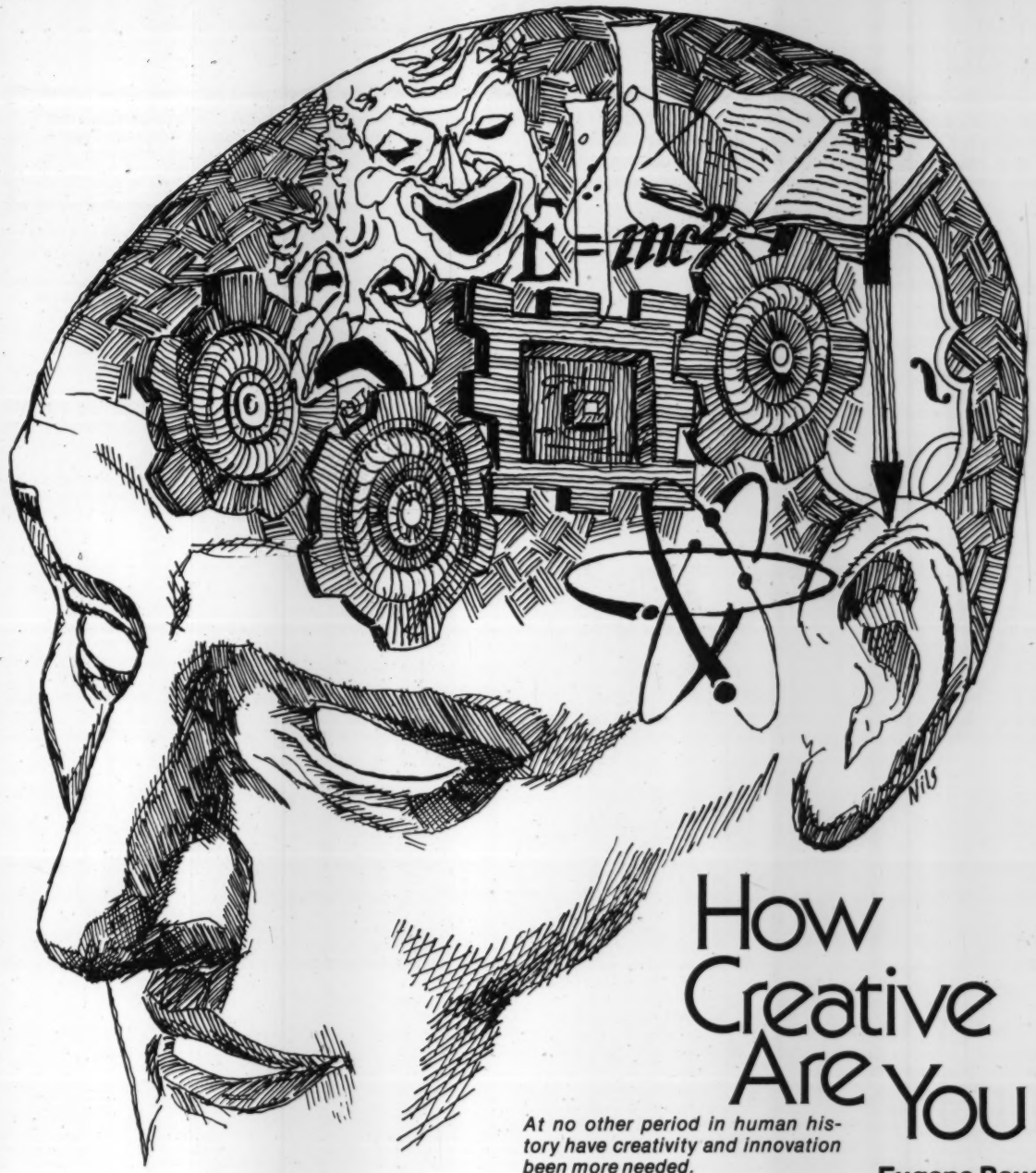


How Creative Are You?

At no other period in human history have creativity and innovation been more needed.
— Eugene J. Koprowski

Eugene Raudsepp

We are now confronting an accelerating rate of change in new technologies, socio-economic trends, and new attitudes and values. The near future promises to bring us, among other challenges: (1) economic uncertainty, (2) rising costs, (3) scarcity of resources, (4) sharper competition, (5) a greater influence of international events in U.S. domestic affairs, (6) quicker-paced demographic changes, (7) rising consumer discontent, (8) greater emphasis on quality of work life, (9) the spector of more government regulation, (10) further decline of productivity and growing employee discontent, etc.

To cope with the uncertainty and complexity that these and other new situations, challenges, and problems present, everyone needs to become more creative, imaginative, and resourceful.

The crucial question is, are you creative enough to meet tomorrow's challenges? Here is a brief test (condensed from a 310-question format), devised by Princeton Creative Research, which enables you to determine if you have the personality traits, attitudes, values, motivations, and interests that best equip you to handle new and difficult situations.

The test is based on several years' study of the characteristics and attributes possessed by men and women - business executives, managers, technical and other professional personnel among them - which predispose them to think and act creatively.

Eugene Raudsepp, President, Princeton Research, Inc., Princeton, N.J.

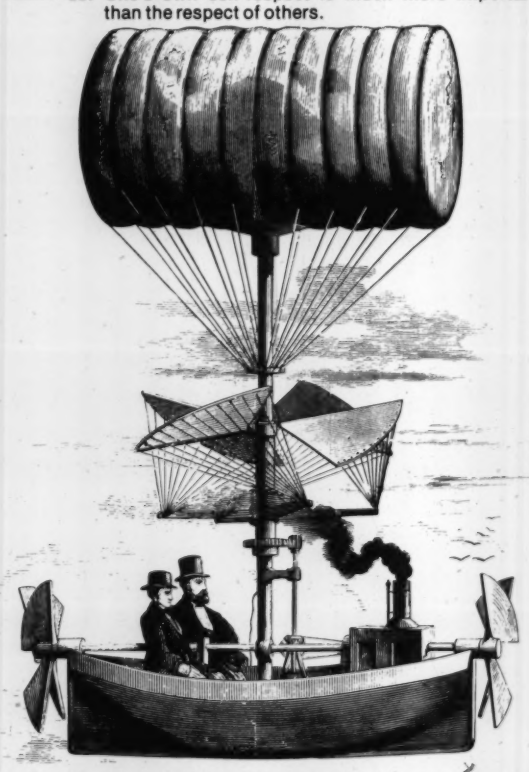
How to take the test

After each statement indicate with a letter whether you **agree** or **disagree** with it: A = Agree; B = In-Between or Don't Know; C = Disagree. Answer as accurately and frankly as possible. Try not to second guess how a creative person might respond to each statement.

For further information about the full 310-question test, entitled "How Creative Are You?" contact Princeton Creative Research, Inc., 10 Nassau St., P.O. Box 122, Princeton, N.J. 08540.

1. I always work with a great deal of certainty that I'm following the correct procedures for solving a particular problem.
2. It would be a waste of time for me to ask questions if I had no hope of obtaining answers.
3. I concentrate harder on whatever interests me than do most people.
4. I feel that a logical step-by-step method is best for solving problems.
5. I occasionally voice opinions in groups that seem to turn some people off.
6. I spend a great deal of time thinking about what others think of me.

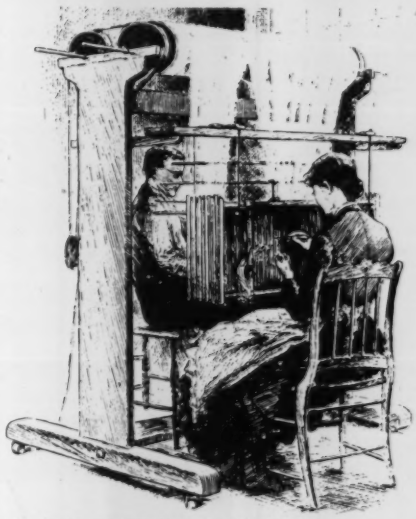
7. It is more important for me to do what I believe to be right than to try to win the approval of others.
8. People who seem unsure and uncertain about things lose my respect.
9. More than other people I need to have things interesting and exciting.
10. I know how to keep my inner impulses in check.
11. I am able to stick with difficult problems over extended periods of time.
12. On occasion I get overly enthusiastic over things.
13. I often get my best ideas when doing nothing in particular.
14. I rely on intuitive hunches and the feeling of "rightness" or "wrongness" when moving toward the solution of a problem.
15. When problem solving, I work faster when analyzing the problem, and slower when synthesizing the information I've gathered.
16. I sometimes get a kick out of breaking the rules and doing things I'm not supposed to do.
17. I like hobbies which involve collecting things.
18. Daydreaming has provided the impetus for many of my more important projects.
19. I like people who are objective and rational.
20. If I had to choose from two occupations other than the one I now have, I would rather be a physician than an explorer.
21. I can get along more easily with people if they belong to about the same social and business class as myself.
22. I have a high degree of aesthetic sensitivity.
23. I am driven to achieve high status and power in life.
24. I like people who are most sure of their conclusions.
25. Inspiration has nothing to do with the successful solution of problems.
26. When I'm engaged in an argument, the greatest pleasure for me would be for the person who disagrees with me to become a friend, even at the price of sacrificing my point of view.
27. I am much more interested in coming up with new ideas than I am in trying to sell them to others.
28. I would enjoy spending an entire day alone, just "chewing the mental cud."
29. I tend to avoid situations in which I might feel inferior.
30. In evaluating information, the source of it is more important to me than the content.
31. I resent things being uncertain and unpredictable.
32. I like people who follow the rule "business before pleasure."
33. One's own self-respect is much more important than the respect of others.



34. I feel that people who strive for perfection are unwise.
35. I prefer to work with others in a team effort rather than solo.
36. I like work in which I must influence others.
37. Many problems that I encounter in life cannot be re-

solved in terms of right or wrong solutions.

____ 38. It is important for me to have a place for everything and everything in its place.
____ 39. Writers who use strange and unusual words merely want to show off.
____ 40. The trouble with many people is that they take things too seriously.
____ 41. I can maintain my motivation and enthusiasm for my projects, even in the face of discouragement, obstacles, or opposition.
____ 42. People who are willing to entertain "crackpot" ideas are impractical.
____ 43. I am more impressed with what I don't know than with what I do know.
____ 44. I am more interested in what could be rather than what is.
____ 45. I often brood about the thoughtless things I have said that may have hurt other people's feelings.
____ 46. I rather enjoy fooling around with new ideas, even if there is no practical payoff.
____ 47. I think the statement, "ideas are a dime a dozen," hits the nail on the head.
____ 48. I don't like to ask questions that show ignorance.
____ 49. Once I undertake a project, I'm determined to finish it, even under conditions of frustration.
____ 50. I sometimes feel that ideas come to me as if from some external source and that I am not directly responsible for them.
____ 51. I sometimes get into trouble because I'm too curious or inquisitive.
____ 52. People often say that I'm somewhat absent-minded.
____ 53. I am more open to my feelings and emotions than are most other people.
____ 54. I am able to more easily change my interests to pursue a job or a career than I can change a job to pursue my interests.
____ 55. People who are theoretically oriented are less important than are those who are practical.
____ 56. When brainstorming in a group, I am able to think up more ideas more rapidly than can most others in the group.
____ 57. I am not ashamed to express "feminine" interests (if man), or "masculine" interests (if woman), if so inclined.
____ 58. I can easily give up immediate gain or comfort to reach the goals I have set.
____ 59. People who express their feelings and emotions are either unstable or immature.
____ 60. In dealing with people, it is more important to be diplomatic than open and direct.
____ 61. It is a waste of time to analyze one's failures.
____ 62. There's nothing wrong with showing off a little now and then.
____ 63. At times I have so enjoyed the ingenuity of a crook that I hoped he would go scotfree.
____ 64. When someone tries to get ahead of me in a line of people, I usually point it out to him.
____ 65. Problems that do not have clear-cut and unambiguous answers have very little interest for me.
____ 66. I'm attracted to the mystery of life.
____ 67. I trust my feelings to guide me through experiences.
____ 68. I frequently begin work on a problem which I can only dimly sense and not yet express.
____ 69. Things that I've accepted as old and familiar sometimes appear to me strange and distant.
____ 70. I frequently tend to forget things such as names of people, streets, highways, small towns, etc.
____ 71. During my adolescence I frequently had a desire to be alone and to pursue my own interests and thoughts.
____ 72. I feel that hard work is the basic factor of success.
____ 73. Many creative breakthroughs are the result of chance factors.
____ 74. To be regarded as a good team member is important to me.



____ 75. I was very happy in my childhood.
76. Below is a list of adjectives and terms that describe people. Indicate with a check mark **ten** (10) words that best characterize you.

____ energetic	____ factual
____ persuasive	____ open-minded
____ observant	____ tactful
____ fashionable	____ inhibited
____ self-confident	____ enthusiastic
____ persevering	____ innovative
____ forward-looking	____ poised
____ cautious	____ acquisitive
____ habit-bound	____ practical
____ resourceful	____ alert
____ egotistical	____ curious
____ independent	____ organized
____ good-natured	____ unemotional
____ predictable	____ clear-thinking
____ formal	____ understanding
____ informal	____ dynamic
____ dedicated	____ self-demanding
____ original	____ polished
____ quick	____ realistic
____ efficient	____ modest
____ helpful	____ involved
____ perceptive	____ absent-minded
____ courageous	____ flexible
____ stern	____ sociable
____ thorough	____ well-liked
____ impulsive	____ restless
____ determined	____ retiring

Scoring Instructions:

To compute your score, circle and add up the values assigned to each item. The values are as follows:

	A Agree	B In-Between or Don't Know	C Disagree
1.	0	1	2
2.	0	1	2
3.	4	1	0
4.	-2	0	3
5.	2	1	0
6.	-1	0	3
7.	3	0	-1
8.	0	1	2
9.	3	0	-1
10.	1	0	3
11.	4	1	0
12.	3	0	-1
13.	2	1	0
14.	4	0	-2
15.	-1	0	2
16.	2	1	0
17.	0	1	2
18.	3	0	-1
19.	0	1	2
20.	0	1	2
21.	0	1	2
22.	3	0	-1
23.	0	1	2
24.	-1	0	2
25.	0	1	3
26.	-1	0	2
27.	2	1	0
28.	2	0	-1
29.	0	1	2
30.	-2	0	3
31.	0	1	2
32.	0	1	2
33.	3	0	-1
34.	-1	0	2
35.	0	1	2
36.	1	2	3
37.	2	1	0
38.	0	1	2
39.	-1	0	2
40.	2	1	0
41.	3	1	0
42.	-1	0	2
43.	2	1	0
44.	2	1	0
45.	-1	0	2
46.	3	2	0
47.	0	1	2
48.	0	1	2
49.	3	1	0
50.	2	1	0
51.	2	1	0
52.	3	1	0
53.	3	0	-1
54.	0	1	2
55.	-1	0	3
56.	2	1	0
57.	3	0	-1
58.	2	0	-1
59.	0	1	2
60.	1	0	2
61.	0	1	2
62.	2	0	-1
63.	2	0	-1
64.	2	1	0
65.	-1	0	3
66.	3	1	0
67.	3	1	0
68.	2	0	-1
69.	2	1	0
70.	3	0	-1
71.	3	1	0
72.	2	1	0
73.	2	1	0
74.	1	0	2
75.	0	1	2

76. The following have values of 2:

energetic	observant	persevering
resourceful	independent	dedicated
original	perceptive	courageous
enthusiastic	innovative	curious
dynamic	self-demanding	involved
flexible		

The following have values of 1:

self-confident	forward-looking	informal
thorough	open-minded	alert
restless	determined	

The rest have values of 0.

180 - 200	EXCEPTIONALLY CREATIVE
150 - 179	VERY CREATIVE
110 - 149	ABOVE AVERAGE
60 - 109	AVERAGE
40 - 59	BELOW AVERAGE
30 - 39	NONCREATIVE

The era of the 'intelligent man' is almost over and a new one is emerging - the era of the 'creative man'. — *Pinchas Noy*

Recommended Reading on Creativity

An extraordinary personal account by Albert Einstein of how he developed the general theory of relativity and his creative thinking process was undiscovered until after his death. A translation and interpretation of this document was published in the January 1979 **American Journal of Psychiatry**. A somewhat easier-to-understand article about Einstein's "Janusian" thinking appears in the March 31, 1979 issue of **Science News**.

An excellent book, **The Five-Day Course in Thinking**, by Edward de Bono (Basic Books, 1967) actually contains three five-day fascinating "courses," one done with bottles and knives for "insight thinking," the second with blocks for "sequential thinking," and the last being the L Game for "strategic thinking."

— DHA

TRS-80 E.S. SERIAL I/O

• Can input into basic • Can use LLIST and LPRINT to output, or output continuously • RS-232 compatible • Can be used with or without the expansion bus • On board switch selectable baud rates of 110, 150, 300, 600, 1200, 2400, parity or no parity odd or even, 5 to 8 data bits, and 1 or 2 stop bits. D.T.R. line • Requires +5, -12 VDC • Board only $19.95 Part No. 8010, with parts $59.95 Part No. 8010A, assembled $79.95 Part No. 8010 C. No connectors provided, see below.

EIA/RS-232 connector Part No. DB25P $6.00, with 9', 8 conductor cable $10.95 Part No. DB25P9.

3' ribbon cable with attached connectors to fit TRS-80 and our serial board $19.95 Part No. 3CAB40.

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• Type 103 • Full or half duplex • Works up to 300 baud • Originate or Answer • No coils, only low cost components • TTL input and output-serial • Connect 8 Ω speaker and crystal mic. directly to board • Uses XR FSK demodulator • Requires +5 volts • Board only $7.60 Part No. 109, with parts $27.50 Part No. 109A

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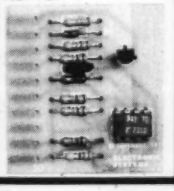
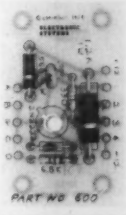
RS-232/ TTL* INTERFACE

• Converts TTL to RS-232, and converts RS-232 to TTL • Two separate circuits • Requires -12 and +12 volts • All connections go to a 10 pin gold plated edge connector • Board only $4.50 Part No. 232, with parts $7.00 Part No. 232A 10 Pin edge connector $3.00 Part No. 10P



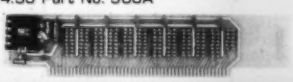
RS-232/ TTY* INTERFACE

• Converts RS-232 to 20mA current loop, and 20mA current loop to RS-232 • Two separate circuits • Requires +12 and -12 volts • Board only $4.50 Part No. 600, with parts $7.00 Part No. 600A

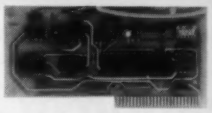


S-100 BUS * ACTIVE TERMINATOR

Board only $14.95 Part No. 900, with parts $24.95 Part No. 900A



APPLE II* SERIAL I/O INTERFACE



Baud rate is continuously adjustable from 0 to 30,000 • Plugs into any peripheral connector • Low current drain. RS-232 input and output • On board switch selectable 5 to 8 data bits, 1 or 2 stop bits, and parity or no parity either odd or even • Jumper selectable address • SOFTWARE • Input and Output routine from monitor or BASIC to teletype or other serial printer • Program for using an Apple II for a video or an intelligent terminal. Also can output in correspondence code to interface with some selectrics. • Also watches DTR • Board only $15.00 Part No. 2, with parts $42.00 Part No. 2A, assembled $62.00 Part No. 2C

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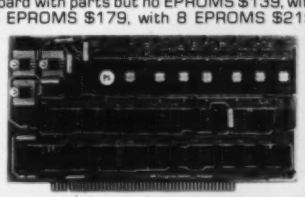
Saves programs on PROM permanently (until erased via UV light) up to 8K bytes. Programs may be directly run from the program saver such as fixed routines or assemblers. • S-100 bus compatible • Room for 8K bytes of EPROM non-volatile memory (2708's). • On-board PROM programming • Address relocation of each 4K of memory to any 4K boundary within 64K • Power on jump and reset jump option for "turnkey" systems and computers without a front panel • Program saver software available • Solder mask both sides • Full silkscreen for easy assembly. Program saver software in 1 2708 EPROM $25. Bare board $35 including custom coil, board with parts but no EPROMS $139, with 4 EPROMS $179, with 8 EPROMS $219.



WAMECO PRODUCTS WITH ELECTRONIC SYSTEMS PARTS

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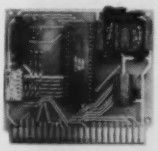

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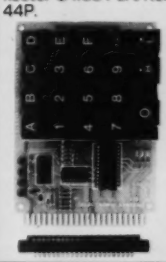

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CIRCLE 114 ON READER SERVICE CARD

Realization of a Public Key Cryptosystem

John D. Brule

In February, 1978, Rivest et. al.[1] published some results on public key cryptosystems. I have implemented their algorithms, along with other multiprecision algorithms given by Knuth[2] in Z-80 machine language. These materials can be obtained from the author of this article.

Rivest's work prepares the way for electronic mail wherein the messages to be transmitted are private and they contain signed proof that only one person could have sent the encrypted message. The essentials of the process are presented in this article, along with a description of how it is implemented.

Figure 1 shows how a public key cryptosystem works. Every user of the system places in the public file an encryption key, call them E_A, E_B, etc. Suppose there are two users, Arthur and Betty. Suppose Betty wishes to send a message to Arthur. (The message itself will be referred to as the plaintext.) Betty creates the plaintext, and translates it to a sequence of numbers via a well known system, like the ASCII code. Table I gives a suggested substitution of numbers for common plaintext symbols. The resulting sequence of numbers is called a multiprecision number and is represented by M in Figure 1. The encryption process starts at this point. For example, Betty could operate on M using her secret decryption key, D_B, forming $S = D_B(M)$. S is thus another multiprecision number. Then, since Betty wants to send the message to Arthur, Betty goes to the public file to get Arthur's public key, E_A. Betty then forms the encrypted message C, where $C = E_A(S) = E_A(D_B(M))$. C is then transmitted to Arthur. It is not necessary to keep C secret, because only Arthur can decode it. Arthur now starts decryption. He knows that Betty was the sender. Arthur first uses his secret decryption key, D_A, giving S. $S = D_A(C) = D_A(E_A(S))$. Since decrypting an encrypted multiprecision number yields the original number, Arthur now has $S = D_A(E_A(S)) = D_A(E_A(D_B(M))) = D_B(M)$.

To get the message, Arthur now goes to the public file to get E_B, and lastly computes $E_B(S) = E_B(D_B(M)) = M$. By this process, Arthur has a signed message which only Betty could have sent, and which Arthur cannot modify.

Now, what are the keys, and how can we get them? At each step the key is the mathematical operation of raising a number to a power, and keeping just the remainder after division by a third number, called the modulus, F. Thus, 6 to the third power, remainder mod 11 is obtained by forming $6^3 = 216$, then dividing by 11 to get a remainder of 7. We write $7 = 6^3 \bmod 11$. The coding and decoding processes use a pair of keys. For example, a pair that will work are:

E = (e,F) = (157,2773)
D = (d,F) = (17,2773)

If the message is, for example, 1462, then $S = M^d \bmod F = 1462^{17} \bmod 2773 = 2200$. Thus, S = 2200 is the encrypted form of the message. Now, to get the original message back we form $2200^{157} \bmod 2773$, and this gives 1462.

Thus, each key is a set of two pairs of numbers. Each user makes one pair public, say (e,F) and keeps the other secret, say (d,F). F is formed as the product of two large secret prime numbers. F = p*q. e is readily selected by the process given below, and once e is obtained, then d is calculated by the programs.

The security of the system rests upon the impracticality of determing the factors p and q, of the publicly known F. The larger that p and q are, the harder F is to factor. Rivest et.al.[1] estimate that if F has 100 digits, it would take a minimum of 74 years of continuous high speed computing to find p and q.

There are thus three processes needed to implement this system. They are:

A. Key generation See Figure 2.
B. Encryption See Figure 3.
C. Decryption See Figure 4.

The programs I have written do all of these operations. All calculations are in machine language, with an executive program in BASIC. The algorithms that implement Figure 2

John D. Brule, Syracuse University, Syracuse, NY, University of San Carlos, Cebu City, Philippines.

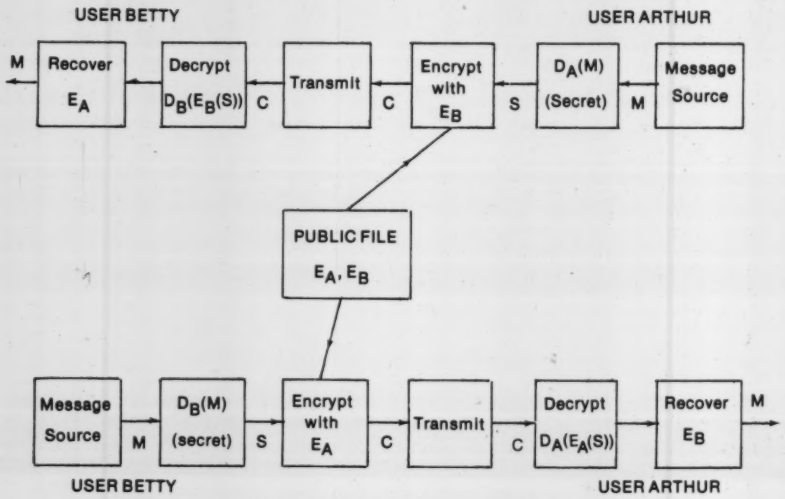

Figure 1. A public key cryptosystem.

allow the user to pick the desired number of places in the prime. Also, to make factoring F as difficult as possible, it is possible to pick p as a prime of the form p = 1 + k*u, where u is a prime, and k is the smallest possible element of the set K = 2,4,6, 8,... Then, once p and q are selected to form F = p*q, algorithms are available to select the last two members of the key, e and d. One will be made public, along with F, and the other will be kept secret.

The encryption algorithm accepts keyboard inputs, and converts each keystroke into a number, according to Table I. Then, blocks of these numbers are intrepreted as places, base 64. The length of the block is kept small enough to that the number represented by the block does not exceed the modulus, F. This is done

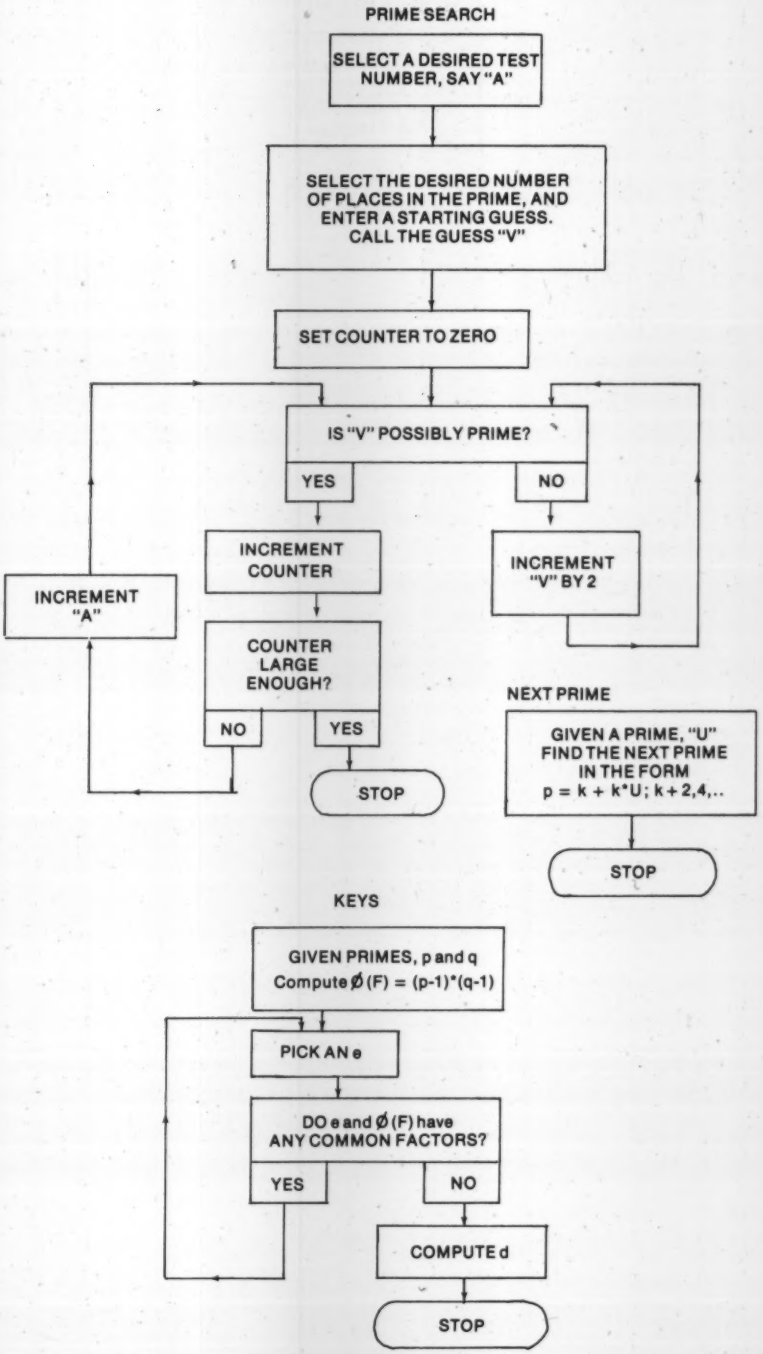
PRIME SEARCH
SELECT A DESIRED TEST NUMBER, SAY "A"
SELECT THE DESIRED NUMBER OF PLACES IN THE PRIME, AND ENTER A STARTING GUESS. CALL THE GUESS "V"
SET COUNTER TO ZERO
IS "V" POSSIBLY PRIME?
YES
NO
INCREMENT COUNTER
INCREMENT "V" BY 2
INCREMENT "A"
COUNTER LARGE ENOUGH?
NO
YES
STOP
NEXT PRIME
GIVEN A PRIME, "U" FIND THE NEXT PRIME IN THE FORM p = k + k*U; k = 2,4,..
STOP
KEYS
GIVEN PRIMES, p and q Compute Ø(F) = (p-1)*(q-1)
PICK AN e
DO e and Ø(F) have ANY COMMON FACTORS?
YES
NO
COMPUTE d
STOP

Figure 2. Key Generation

01	space
02	! exclamation
03	" quote
04	# number sign
05	$ dollar sign
06	% percentum
07	& ampersand
08	' apostrophe
09	(left paren.
10	) right paren.
11	* asterisk
12	+ plus
13	, comma
14	- dash
15	. period
16	/ slash
17	0 zero
18	1 one
19	2 two
20	3 three
21	4 four
22	5 five
23	6 six
24	7 seven
25	8 eight
26	9 nine
27	: colon
28	; semicolon
29	less than
30	= equal
31	greater than
32	? question
33	at
34	A
35	B
36	C
37	D
38	E
39	F
40	G
41	H
42	I
43	J
44	K
45	L
46	M
47	N
48	O
49	P
50	Q
51	R
52	S
53	T
54	U
55	V
56	W
57	X
58	Y
59	Z
60	up arrow
61	down arrow
62	left arrow
63	right arrow

EXAMPLE: IS THE COST OF #5 $5.01?
Base 64 Code: 42,52,01,53,41,38,01,36,48,52, 53,01,48,39,01,04,22,01,29,01, 05,22,15,17,18,32
Groups of these places are formed, starting at the left, and encoded using the following modulus, F. Here F is presented twice, first as a string of base 10 digits, then as a sequence of base 256 places.
F = 137083099875322948466329531409411993 011 (base 10 digits) = 103,33,62,164,33,97,130, 25,71,155,135,75,126,221,237,179 (base 256)
To encrypt a message to me, use the above modulus, F, and the following encrypter, E;
E = 1384571 (base ten digits)
= 21,32,124 (base 256 places)

Table I, Modified ASCII Code.

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CIRCLE 177 ON READER SERVICE CARD

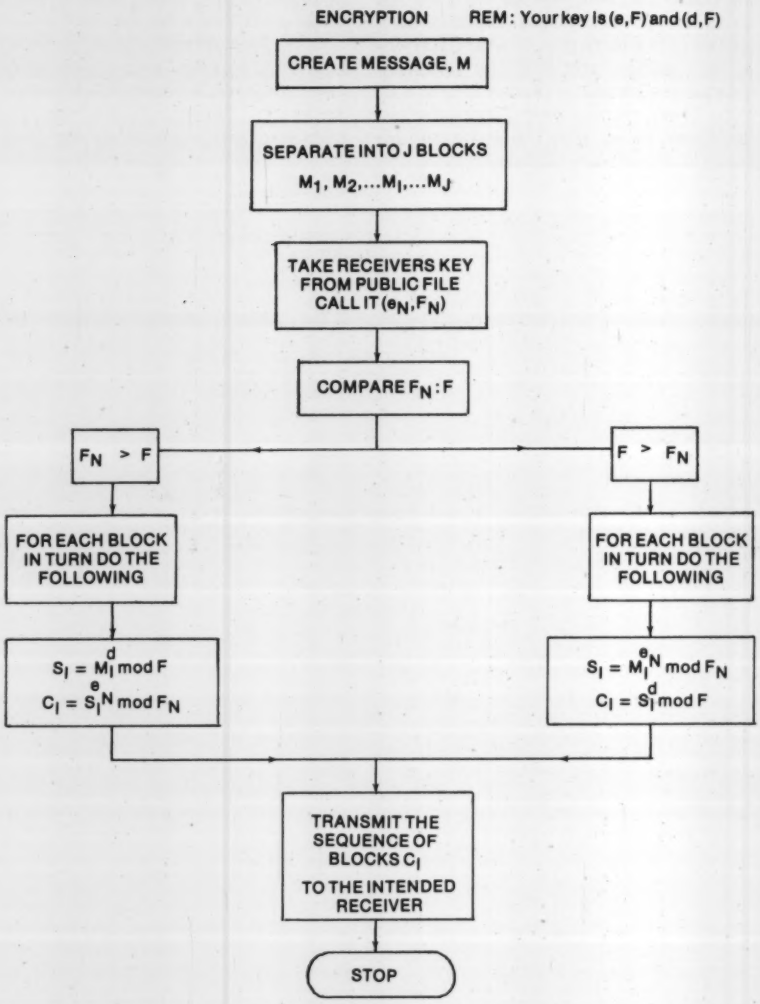
ENCRYPTION
REM: Your key is (e,F) and (d,F)
CREATE MESSAGE, M
SEPARATE INTO J BLOCKS
$M_1, M_2, \ldots M_I, \ldots M_J$
TAKE RECEIVERS KEY FROM PUBLIC FILE CALL IT (e_N, F_N)
COMPARE F_N : F
$F_N > F$
$F > F_N$
FOR EACH BLOCK IN TURN DO THE FOLLOWING
FOR EACH BLOCK IN TURN DO THE FOLLOWING
$S_I = M_I^d \bmod F$
$C_I = S_I^e \bmod F_N$
$S_I = M_I^e \bmod F_N$
$C_I = S_I^d \bmod F$
TRANSMIT THE SEQUENCE OF BLOCKS C_I
TO THE INTENDED RECEIVER
STOP

Figure 3. Encryption with Signature.

automatically in the program. (A further option, not shown in the block diagram, is available to select whether a signature is to be used.) Then, each block is raised to the appropriate power, mod the appropriate modulus. This is repeated for the case of a signed message. Upon completion of encryption, the code to be transmitted is displayed.

Decryption starts by allowing the user the option of entering the code either as a base 256 multiprecision number, or as a string of base 10 characters. Each line of code is decrypted, changed to a base 64 multiprecision number, and then displayed as plaintext.

All of the programs are available on tape, along with a more complete description of how to use them. I wrote the programs as my own introduction to Z-80 assembly language. To run them, one needs a TRS-80 with Level II BASIC and at least a 16K RAM. The programs themselves require less than 4K of memory, but they are located high in memory. In TABLE I, I have included my encryption key, (e,F). I present them in both base 256 form, and as base 10 digits. If anyone wishes to communicate with me, I will respond. □

Footnotes:

1. Rivest, Shamir, Alleman, A Method for Obtaining Digital Signatures and Public Key Cryptosystems. Comm. of Acm. February, 1978.

2. Knuth, The Art of Computer Programming, Vol. 2. Semi Numerical Algorithms.

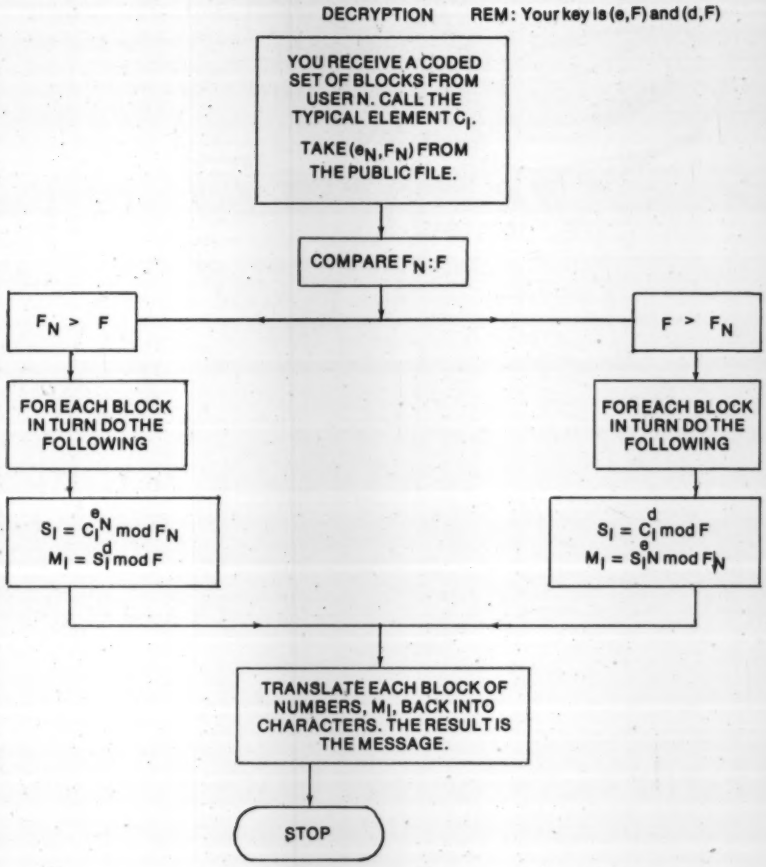
DECRYPTION REM: Your key is (e,F) and (d,F)
YOU RECEIVE A CODED SET OF BLOCKS FROM USER N. CALL THE TYPICAL ELEMENT C_I.
TAKE (e_N, F_N) FROM THE PUBLIC FILE.
COMPARE F_N:F
$F_N > F$
$F > F_N$
FOR EACH BLOCK IN TURN DO THE FOLLOWING
FOR EACH BLOCK IN TURN DO THE FOLLOWING
$S_I = C_I^e{}_N \bmod F_N$
$M_I = S_I^d \bmod F$
$S_I = C_I^d \bmod F$
$M_I = S_I^e{}_N \bmod F_N$
TRANSLATE EACH BLOCK OF NUMBERS, M_I, BACK INTO CHARACTERS. THE RESULT IS THE MESSAGE.
STOP

Figure 4. Decryption with Signature.

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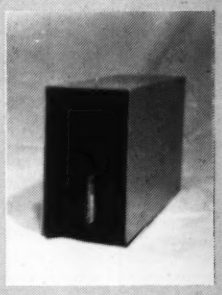

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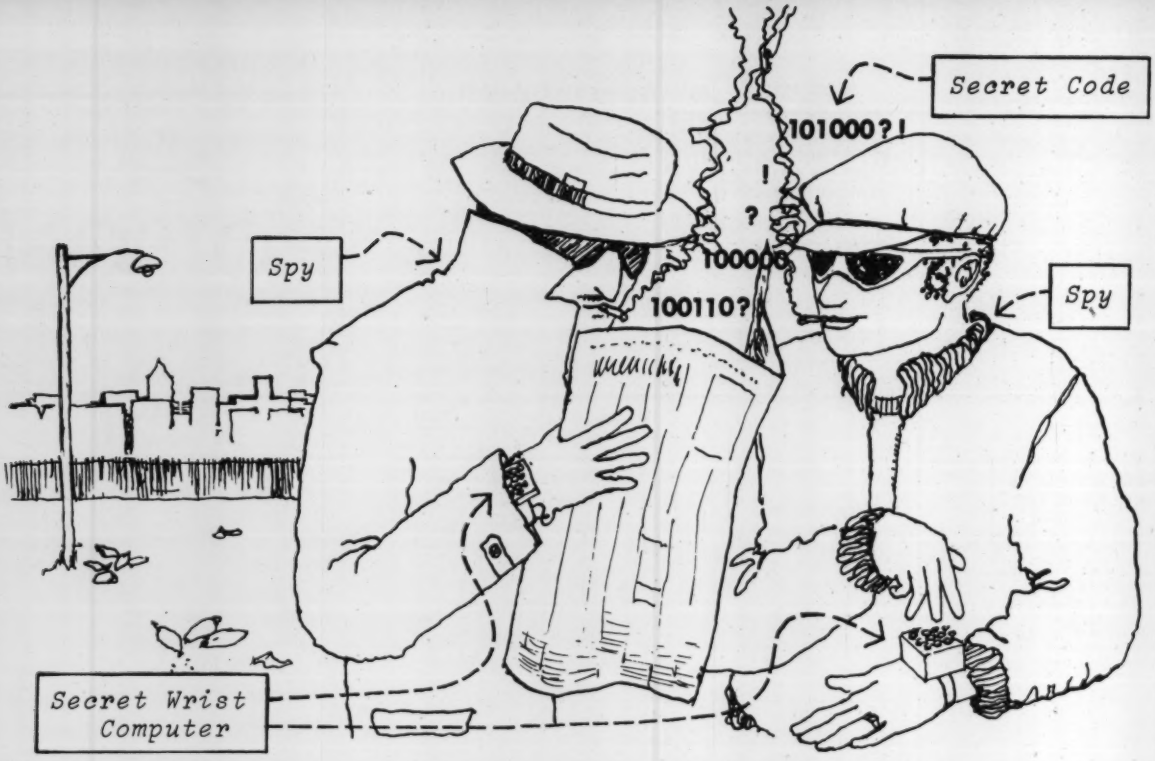


Distance and Error - Correcting Codes

This is a reprint of one of the original Project Solo curriculum modules developed at the University of Pittsburgh. Project Solo was supported in part by the National Science Foundation, and it was directed by Tom Dwyer and Margot Critchfield. The modules were authored by various persons, including project staff, teachers, and students.

It should be kept in mind that Project Solo began in 1969 (which is probably before some of Creative's readers were born). Undoubtedly, many of the modules would be done differently today. There are also surely errors to be found, and neither Creative Computing, the authors, or NSF can warrant the accuracy of the reprints. But as a starting point for your own explorations, they should make a good (albeit slightly ancient) set of shoulders to stand upon. We hope you enjoy the view.

A binary code of length N is a string of N 0's or 1's. For example, if N = 3, all the possible binary codes are 000, 001, 010, 011, 100, 101, 110, and 111. We speak of these as 3 bit codes (1 and 0 are called bits).

These codes could be used to represent eight objects of any sort—the members of a musical octet, the digits 0,1,2,3,4,5,6,7 in a computer, or the letters A,B,C,D,E,F,G,H.

Now for some intrigue

Let's assume that we wish to assign binary code names to the agents of STICK (Society to Increase Contact for Keeps), an international ring of glue thieves.

Suppose we only have two agents but eight codes. Question: Can we assign codes so that:

a. The computer will check code authenticity **without** knowing the correct codes?

b. The computer can give the correct code even though the agent has deliberately changed one bit (to throw off eavesdroppers)?

To see how codes can be assigned to make this possible, let's place the codes at the vertices of a cube.

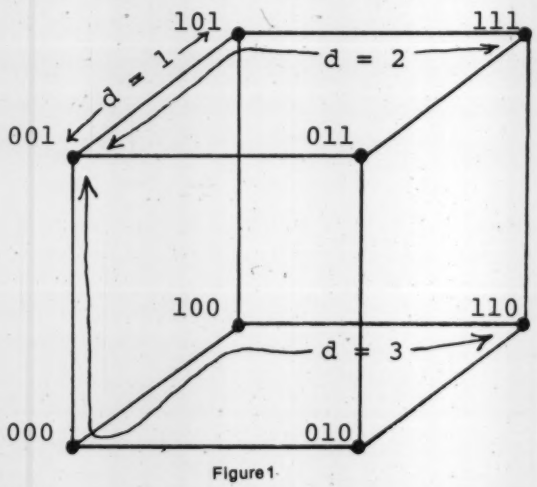


Figure 1

To be more precise, we should call Figure 1 a "3-dimensional cube." A picture of a "4-dimensional cube" (which has $2^4 = 16$ vertices) is shown in Figure 2. Thus we can associate a unique four-bit code with each vertex of a 4-D cube. Can you generalize this statement?

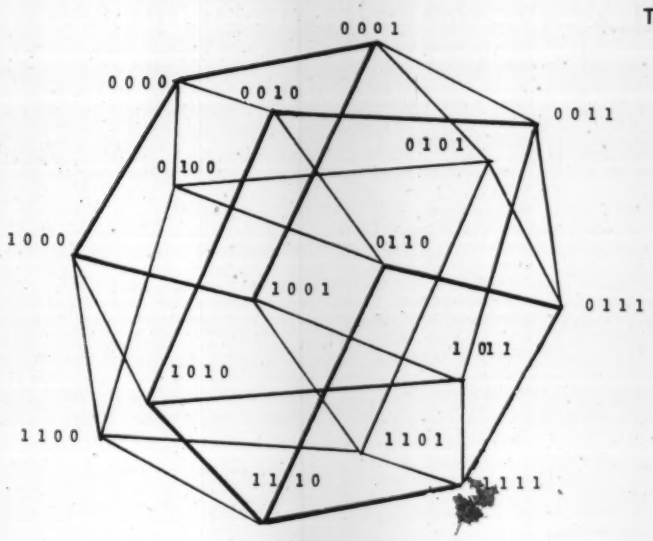
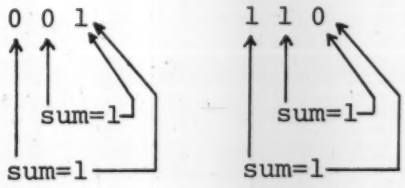


Figure 2

We will define the number of bits by which two codes differ as the "distance" (= d) between these codes. Thus, for example, the distance between 001 and 101 is d = 1, the distance between 001 and 111 is d = 2, and the distance between 001 and 110 is d = 3. Math students: Is this a legal use of the word distance? Notice that our picture has been drawn so that "distance" between codes corresponds to the number of edges of the cube you would have to walk along to get from one vertex to the other.

Let's assign our two authentic agents the codes 001 and 110 (which are a distance of three from each other). Now suppose one agent walks up to another and says, "My code is 101."

(a) How can we tell if it is an authentic code? One way would be to simply compare it to the list of authentic codes! However, if there were to be very many codes, such a search of the authentic list would be time consuming. Besides, we don't want this authentic list stored in too many places! There is another way to check authenticity.
In our example the two authentic codes have the property that if we add the first and third bits of the code we get 1, and this is also true if we add the second and third bits.



For all other codes this is false.

NOTE:	0 + 1 = 1 and 1 + 0 = 1 in binary arithmetic.
ALSO NOTE:	0 + 0 = 0, but 1 + 1 = 0 (with carry of 1)
FURTHER:	0*1 = 0, 1*0 = 0, 0*0 = 0 and 1*1 = 1

Thus the code 1 0 1 our agent gave is not authentic.

Since: 1 + 1 = 0

(b) Suppose our agent deliberately changes one bit in his code when giving it verbally. Applying the above rule will detect the error, but can we figure out what the correct code should have been?
We can see the answer from our diagram. An authentic code which has only one bit changed is distance d = 1 from the original correct code, but distance d = 2 from the other correct code. Thus 101 has to be corrected back to 001, **not** to 110.
Try to develop an algorithm for making corrections in codes which have 1 bit in error: Here is how you might reason:

Let's call the 3 bits: B1, B2, and B3.

For 101 B1 + B3 = 0 WRONG
B2 + B3 = 1 RIGHT

∴ Change B1, Correct code is: 001

For 111 B1 + B3 = 0 WRONG
B2 + B3 = 0 WRONG

∴ Change B3, Correct code is: 110 etc.

Problems: Write programs for your wrist computer to handle the following:

1. The Two-Agent Problem
Authentic Codes: 101 and 010

INPUT: Any 3 bit code which is either an authentic code, or which contains an error in 1 bit.
OUTPUT: The Message: "AUTHENTIC CODE"
OR: "CODE IN ERROR
CODE SHOULD BE _____"

2. Can use of a 4 bit code (see Figure 2) permit additional outputs for the above "Two-Agent" analysis program?

3. Four-Agent Problem
Authentic Codes are: SMITH 0 0 0 0 0
BOND 1 1 1 0 0
SPIRO 0 0 1 1 1
JONES 1 1 0 1 1

INPUT: Any code
OUTPUT: The Message: "AUTHENTIC CODE"
OR: "1 BIT ERROR —
CORRECT CODE IS _____"
OR: "ERROR >= 2 BITS —
DOUBLE AGENT"

4. Here is a set of six bit codes to play with: 000000, 000111, 111000, 110110, 011011, 101101. (NOTE: d >= 3 for any two of these codes.)

Sample Solution — Problem 1

```
10  S(1) = 0
20  S(2) = 1
30  PRINT "Two-Agent Problem"
40  PRINT "To end program, type the characters END when asked for a code."
50  PRINT
60  PRINT "Enter a 3-bit code."
70  INPUT B$
80  IF B$ = "END" THEN 280
90  GOSUB 300
100  S(3) = S1
110  S(4) = S2
120  IF (S(1) = S(3) AND S(2) = S(4)) THEN 260
130  IF (S(1) <> S(3) AND S(2) <> S(4)) THEN 180
140  X = 1-S(3)
150  IF (S(1) = X) THEN 200
160  X = 1-S(4)
170  IF (S(2) = X) THEN 220
180  B3$ = RIGHT$(STR$(1-VAL(B3$)),1)
190  GOTO 230
200  B1$ = RIGHT$(STR$(1-VAL(B1$)),1)
210  GOTO 230
220  B2$ = RIGHT$(STR$(1-VAL(B2$)),1)
230  PRINT "Code in error."
240  PRINT "Code should be: ";B1$+B2$+B3$
250  GOTO 50
260  PRINT "Authentic code."
270  GOTO 50
280  STOP
290  END
300  B1$ = LEFT$(B$,1)
310  X$ = RIGHT$(B$,2)
320  B2$ = LEFT$(X$,1)
330  B3$ = RIGHT$(B$,1)
340  S1 = VAL(B1$) + VAL(B3$)
350  S2 = VAL(B2$) + VAL(B3$)
360  IF S1 = 2  THEN LET S1 = 0
370  IF S2 = 2  THEN LET S2 = 0
380  RETURN
```

```
RUN
Two-Agent Problem
To end program, type the characters END when asked for a code.

Enter a 3-bit code.
? 000
Code in error.
Code should be: 010

Enter a 3-bit code.
? 001
Code in error.
Code should be: 101

Enter a 3-bit code.
? 010
Authentic code.

Enter a 3-bit code.
? 011
Code in error.
Code should be: 010

Enter a 3-bit code.
? 100
Code in error.
Code should be: 101

Enter a 3-bit code.
? 101
Authentic code.

Enter a 3-bit code.
? 110
Code in error.
Code should be: 010

Enter a 3-bit code.
? 111
Code in error.
Code should be: 101

Enter a 3-bit code.
? END
```

Sample Solution — Problem 3

```
LIST
10 PRINT "Four-Agent Problem"
20 PRINT "To end program, type the characters END when asked for a code."
30 PRINT
40 CLEAR :  REM Sets all variables to zero
50 PRINT "Enter a 5-bit binary code."
60 INPUT B$
70 IF B$="END" THEN 520
80 B1$ = LEFT$(B$,1)
90 X$ = RIGHT$(B$,4)
100 B2$ = LEFT$(X$,1)
110 X$ = RIGHT$(B$,3)
120 B3$ = LEFT$(X$,1)
130 X$ = RIGHT$(B$,2)
140 B4$ = LEFT$(X$,1)
150 B5$ = RIGHT$(X$,1)
160 S(1) = VAL(B1$) + VAL(B2$)
170 S(2) = VAL(B4$) + VAL(B5$)
180 S(3) = VAL(B1$) + VAL(B4$)
190 S(4) = VAL(B2$) + VAL(B5$)
200 FOR I=1 TO 4
210   IF S(I) = 2 THEN S(I) = 0
220 NEXT I
230 IF S(1) <> 0 THEN LET F1 = 1
240 IF S(2) =  0 THEN 270
250 IF F1 = 1 THEN 500
260 F2 = 1
270 IF VAL(B3$) <> S(3) THEN LET F3 = 1
280 IF VAL(B3$) <> S(4) THEN LET F4 = 1
290 K = F1 + F2 + F3 + F4
300 IF K = 0 THEN 480
310 IF K <> 2 THEN 500
320 IF (F1 + F3)<>2 THEN 350
330 B1$ = RIGHT$(STR$(1-VAL(B1$)),1)
340 GOTO 450
350 IF (F1 + F4)<>2 THEN 380
360 B2$ = RIGHT$(STR$(1-VAL(B2$)),1)
370 GOTO 450
380 IF (F3 + F4)<>2 THEN 410
390 B3$ = RIGHT$(STR$(1-VAL(B3$)),1)
400 GOTO 450
410 IF (F2 + F3)<>2 THEN 440
420 B4$ = RIGHT$(STR$(1-VAL(B4$)),1)
430 GOTO 450
440 B5$ = RIGHT$(STR$(1-VAL(B5$)),1)
450 PRINT
460 PRINT " 1 bit error--- Correct code is: ";B1$+B2$+B3$+B4$+B5$
470 GOTO 30
480 PRINT " Authentic code."
490 GOTO 30
500 PRINT " Error = 2 bits --- Double Agent!"
510 GOTO 30
520 STOP
530 END
```

```
RUN
Four-Agent Problem
To end program, type the characters END when asked for a code.

Enter a 5-bit binary code.
? 00000
 Authentic code.

Enter a 5-bit binary code.
? 10000

 1 bit error--- Correct code is: 00000

Enter a 5-bit binary code.
? 00100

 1 bit error--- Correct code is: 00000

Enter a 5-bit binary code.
? 00010

 1 bit error--- Correct code is: 00000

Enter a 5-bit binary code.
? 11011
 Authentic code.

Enter a 5-bit binary code.
? 11010

 1 bit error--- Correct code is: 11011

Enter a 5-bit binary code.
? 10011

 1 bit error--- Correct code is: 11011

Enter a 5-bit binary code.
? 10101
 Error = 2 bits --- Double Agent!

Enter a 5-bit binary code.
? 10110
 Error = 2 bits --- Double Agent!

Enter a 5-bit binary code.
? END
```

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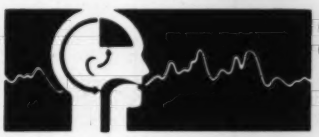

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CIRCLE 138 ON READER SERVICE CARD

Your Basic Binary Search: Simple Data Base Techniques In BASIC

Robert Goff, M.D.

Data base design considerations — with parallel listings in North Star BASIC and CBASIC.

Introduction

Our home computer is on an errand of mercy. One of the kids has eaten a book of matches. The doctor can't be reached. The emergency room receptionist put my call on "hold" until the intern is free. But I know that my computer contains a disk library of household products and can tell me what emergency measures are necessary. While I'm waiting for someone on the other end of the line to get back to the phone, I insert the "POISON" disk, type "MATCHES", and 4 seconds later the CRT displays the following message:

DOCTORS OFFICE 653-6707
EMERGENCY ROOM 654-5600
POISON CONTROL 911

MATCHES
A toxic solid material.

If victim is alert, give IPECAC:

AGE	DOSE	Glasses of Milk
Up to 1	1-2 tsp.	1/2-1
1-4	3 tsp.	1
4-8	4 tsp.	1-2
8-12	5 tsp.	2-3
12 to Adult	6 tsp.	1

and CALL FOR ASSISTANCE

Someone has picked up the phone. "This is Dr. Jones." I explain what has happened and how old the child is. "Well, they're not too toxic, but we really ought to get it out of his stomach. Since you have ipecac at home, why don't you go ahead and give him 3 teaspoons of it, and a glass of water or milk. Call me back if you have any problems with it."

How does my computer search through hundreds upon hundreds of product and substance names so quickly? It's easy. Of the 900 names in its vocabulary, it only had to look at 10 entries in order to find the one I requested. If there were 64,000 entries it would still only need to look at 17 before it either found the entry or discovered that it was not in the vocabulary. (Actually the slowest part of the search is the time required for my North Star Micro-disk drive to start up its motor and get up to the proper rotational speed.) The secret lies in its use of the binary search.

Robert Goff M.D., Research Associate, Children's Hospital Medical Center of Northern California, 51st and Grove, Oakland, CA 94609.

The Binary Search

What is a binary search? Let's start off by describing a **serial search**. I want to look up "rapidity" in my Oxford English Dictionary. I open volume one, turn to the first page of entries, and begin to read each entry, in order. By dinner time I have made it through volume one, and a third of volume two. Maybe I'll reach "rapidity" by next week some time. My 12 year old son tactfully points out that on the spine of each of the 13 volumes of the dictionary there is a key to the vocabulary which may be found in that volume. That makes the task considerably easier. But what if there were no keys on each volume? Is there a way that we could speed up this search?

Yes, a crude binary search. Somewhere within these 13 volumes and millions of entries I should find the word "rapidity." I start by opening the middle volume (volume 7) near the middle of that volume. I read one entry — "incredible." Already I have reduced my task by half, because I know that "rapidity" occurs later in the alphabetical listing than "incredible." I can now ignore all entries below my present entry. I now take the remaining 6½ volumes and find an entry that is roughly half way between "incredible" and the end of the dictionary. We find that this entry is "promising." It is still less than "rapidity," so I will divide in half the pages from "promising" to the end. "Tachistoscope" is the next entry encountered. Now we've past it. "Rapidity" is less than "tachistoscope," but we already know that it is greater than "promising." We take the pages between "promising" and "tachistoscope," divide them in half, and take another look.

As you can see, each time that an entry is examined, the size of the list is reduced by 50%. A list that contains 60,000 entries will require only one more look than a list with 30,000 entries. As it happens, when most of us pick up a single-volume dictionary to find a particular word, we in fact use a crude binary search, at least until we have located the proper page. Then we find the desired entry by serially searching that page.

A binary search is not possible on every list, but the prerequisites for a binary search are few and simple. The list to be searched must be:

1. ordered (alphabetically or numerically)
2. dense (no empty entries in the middle of the list)

The dictionary is ordered alphabetically, as is my computer's list of household poisons. A list of addresses, for example, may be ordered numerically, by zip code, or alphabetically by name, or by city, or by state, etc. The requirement that the list be ordered only applies to the key — the portion of the entry that will be used in the search. Entire mystery novels could be used for each entry in the list, but only the key for each of them (let's say the title, or perhaps the author) must be used to order the list.

The second requirement, that the list be dense, is necessary because the search algorithm must be able to decide, by looking at any entry, if the desired entry is greater-than or less-than the present entry. This is not possible if the entry examined is empty. The dictionary is a dense list. There are no empty entries and no room at the end of the volume for adding new entries. My household poisons list is semi-dense, that is, while there are no "holes" within the list, there is an empty portion at the end, beyond the last entry. This allows room for the addition of new entries to the list. A semi-dense list

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CIRCLE 117 ON READER SERVICE CARD

can be searched in the same manner as a dense list, by simply ignoring the empty expansion room at the end of the list.

The process of constructing a binary search is fairly simple. While there are several possible methods, this discussion will focus on only one of them. Initially several terms must be defined.

N = number of records in the list.
L = (Lower) the record number of the lowest record.
U = (Upper) the record number of the highest record.
F = fence (this is the record we examine with each look)
K = the Key for which we are searching.
[F] = the key of the record at the fence.

The algorithm for the search is shown in Figure 1. To begin, the lower limit (L) is set to the first record in the list; the upper limit (U) is set to the last record. For a list of N records, U = N initially. The first look at a record will be determined by calculating a "fence" (F) approximately half-way between L and U.

$$F = INT((L + U)/2)$$

The fence must always be a whole number, and the INTeger function will always round downward. Using F as the record number, look at record number F, and compare its key, [F], to K, the key for which we are searching. If they are the same, then the search is over. If they are different, then we must decide whether to look at the upper half of the list, or the lower half. Let us say, for example, that [F] K. Then we know that K should be found in the lower half of the list.

To examine the lower half, keep the lower limit (L) the same, but reset the upper limit (U) to be one less than the fence (F). (Since the present fence has already been examined, and is not the record for which we are searching, it can be excluded from the remainder of the search by setting the new upper limit equal to F-1.)

$$U = F - 1$$

Now a new fence is calculated which will be approximately half way between L and the new U. Half the original list has been eliminated!

If, on the other hand, the record at the fence is less than K, then we know that K should be found in the upper half of the list. So the upper limit (U) is kept unchanged, and the lower limit (L) is reset to be one greater than the present fence:

$$L = F + 1$$

and again a new fence is calculated to be approximately half-way between U and the new L.

Continuing this process, a fence is eventually calculated which is the desired record. If we search for a key which is not in the list, then we will know that it is absent as soon as the upper and lower limits are either equal, or have switched places (L > U):

IF L > = U THEN.....K is not present in the list. [Without this last test (L > = U) the algorithm would continue to test the list with the upper limit below the lower limit.]

The simplest example of programming the binary search is for a one dimensional numeric array, say A(n). For simplicity, I will give the array a dimension of 20, and will have it contain the numbers 10, 20, 30, 40, etc. up through 200. [Remember that a list for a binary search must be ordered and dense.] We will look for the member of the list which contains "130". This is shown in Listing 1.

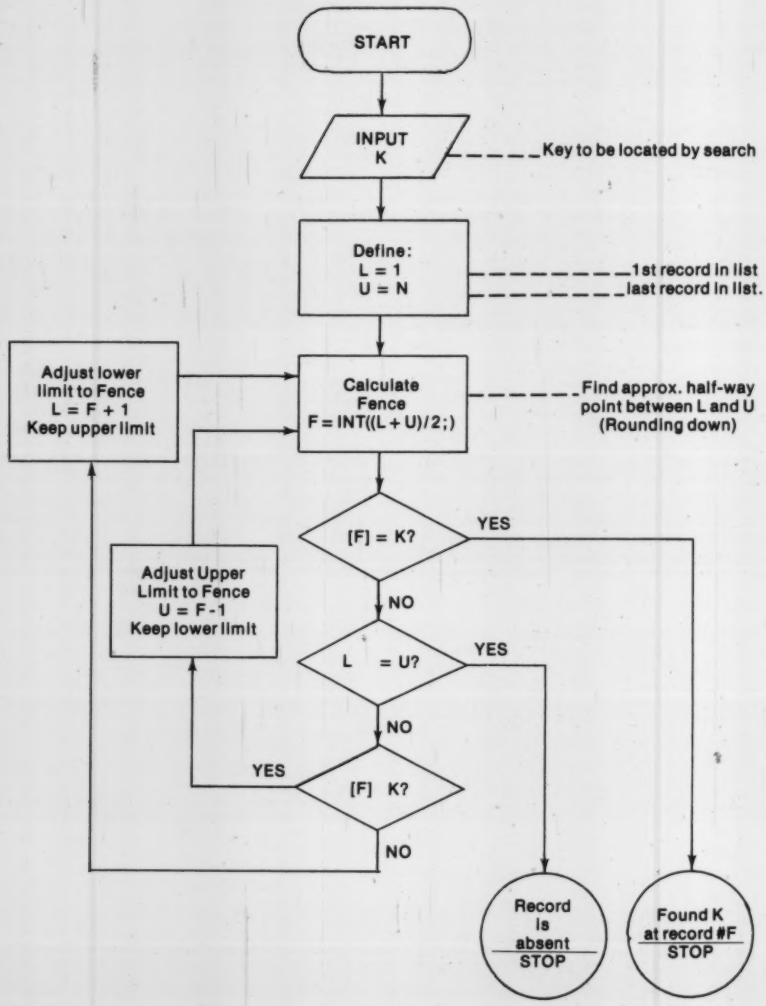
The actual search is shown in Listing 2. While the search algorithm is easier to follow in Listing 2, a run of the program in Listing 1 will print out each of the search parameters for each "look" at the list. By changing the value of N in line 22, you can demonstrate for yourself how many "looks" are required for any size list (try 100, then try 1000).

After watching it find a number in the list, try changing the value of K in line 100 to a number not present in the list, such as 133.

This kind of simple search is seldom of practical value. We need to be able to search a list of names, for example, in order to find John's

Figure #1

The Binary Search (symbols defined in text)


START
INPUT K
Key to be located by search
Define: L = 1 U = N
1st record in list
last record in list.
Adjust lower limit to Fence L = F + 1 Keep upper limit
Calculate Fence F = INT((L + U)/2;)
Find approx. half-way point between L and U (Rounding down)
[F] = K?
YES
NO
Adjust Upper Limit to Fence U = F - 1 Keep lower limit
L = U?
YES
NO
YES
[F] K?
NO
Record is absent STOP
Found K at record #F STOP

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CIRCLE 162 ON READER SERVICE CARD

Binary, con't....

```
1 REM ************** LISTING #1 ****************
2 REM ********* North Star and CBASIC **********
10 REM ** BINARY SEARCH OF 1 DIMENSIONAL ARRAY**
20 REM    SET UP SAMPLE ARRAY
22      N=20     :REM NUMBER OF ENTRIES IN THE LIST
30 DIM A(N)
40    FOR Y=1 TO N
50      A(Y)=Y*10
60    NEXT Y
70 REM *** DEFINE SEARCH PARAMETERS
80      U=N      :REM INITIAL UPPER LIMIT
90      L=1      :REM INITIAL LOWER LIMIT
100     K=130    :REM THIS IS THE KEY TO BE FOUND
110 REM ******* BEGIN BINARY SEARCH *******
120 F=INT((L+U)/2)       :REM CALCULATE FENCE
122             PRINT
124             PRINT "UPPER =";U;"   LOWER = ";L
126             PRINT "LOOKING AT ENTRY #";F
130 IF A(F)=K THEN 250   :REM FOUND IT
140 IF L>=U THEN 220     :REM NOT PRESENT IN LIST
150 IF A(F)>K THEN 190   :REM CHECK LOWER HALF OF LIST
158 REM **** CHECK UPPER HALF OF LIST
160     L=F+1            :REM RESET LOWER LIMIT TO FENCE
170     GOTO 120         :REM KEEP SEARCHING
180 REM **** CHECK LOWER HALF OF LIST
190     U=F-1            :REM RESET UPPER LIMIT TO FENCE
200     GOTO 120         :REM KEEP SEARCHING
210 REM **** NOT FOUND
220             PRINT K;" CANNOT BE FOUND"
230             STOP
240 REM **** FOUND IT
250             PRINT "LOCATED";K;" AT ENTRY #";F
260     END
```

```
1  REM ********* LISTING #2 ***************
2  REM **** North Star and CBASIC ********
120 F=INT((L+U)/2)
130 IF A(F)=K THEN 250
140 IF L>=U THEN 220
150 IF A(F)>K THEN 190
160     L=F+1
170     GOTO 120
190     U=F-1
200     GOTO 120
220             STOP
250             PRINT "LOCATED AT";F
260     END
```

telephone number.

Let us assume that we have a data file on a floppy disk. The file contains 20 records. Each record is a string of 30 ASCII characters. Within each record, the first 10 characters contain the first name of a friend; the last 7 characters contain that friend's phone number. The 13 characters in between are undefined. John's record looks like this:

```
JOHN       ??????????????6545600
!^^^^^^^^^!^^^^^^^^^!^^^^^^^^^!
1          10         20        30
```

The markers and numbers below the record are for clarity only, and, of course, do not appear in the record itself. Notice that the "name field" is filled in with blanks, so that the name JOHN actually consists of 10 characters, the last 6 of which are blanks. The names of some of our friends may be shorter, or may fill all ten spaces allotted, but, like JOHN, any that are shorter than 10 must be filled in with blanks. Although the entire record for each friend can only be read as a 30 character string, we must use only the name as the key.

To search for JOHN in our list of friends, we input the four character name, JOHN. As shown in Listings 3a and 3b, the program must pad this input with blanks, so that it is compatible with our records. If instead, we only searched for a key whose first four characters were JOHN, then we might confuse him with another friend, JOHN-PAUL.

Now we can begin to look for K$, which contains:

"JOHN "

Even though we are only checking the first 10 characters of each record, we can only look at it by reading all 30 at once, as a string. Another complication is that the records within the file are separated from one another by markers, (In CBASIC, each string in a file is actually contained within quotes.) so that each 30 character string occupies a total of 32 bytes. [In North Star BASIC, add 2 to the length of every string to determine the space that it occupies on the disk. In CBASIC, an additional 2 bytes must be allowed for a carriage return and line feed at the end of each record for the type of files used here (fixed record length).] We are going to "look" at 32 (or 34, in CBASIC) byte records to read a 30 character string. The name of our file is "FRIENDS," (see Listings 4a and 4b) and, as we have noted, it contains 20 entries.

In opening a file, it must be assigned a number, by which all subsequent references to that file will be made. In CBASIC, a record length (RECL) must be indicated at the time of opening, in order to use "random access" reading (non sequential). This is indicated in North Star BASIC by a percent sign in each READ statement. In line 100, F (the fence) is used as the relative record number of the record that is to be read. If F = 1 then we will read the first 32 byte (or 34 byte) record in the file. (Actually in North Star BASIC [%32*0] is the first record of the file, but so long as it was not used in writing the file, we can ignore it in reading the file.)

Once we have located the record with the key:

"JOHN "

the phone number can be extracted from the record with line 210 in Listings 4a and 4b.

```
1 REM ************** LISTING 3a ******************
2 REM *********** North Star BASIC ***************
3 REM ******* PADDING INPUT WITH BLANKS ***********
12 DIM F$(30), A$(36), E$(12):REM USED IN OTHER LISTINGS
20 INPUT "NAME? ",K$
30 K1$="          "    :REM 10 BLANKS
40 K1$(1,LEN(K$))=K$
50 K$=K1$
52 RETURN
```

```
1 REM ************** LISTING 3b ******************
2 REM ***************** CBASIC *********************
3 REM ******* PADDING INPUT WITH BLANKS ***********
20 INPUT "NAME?";LINE K$
30 K$=LEFT$(K$+"          ",10) REM 10 BLANKS
52 RETURN
```

```
57 REM ************ LISTING 4a ******************
58 REM ******** North Star BASIC ****************
59 REM ********* SEARCH FOR NAME ****************
60 OPEN #1,'FRIENDS'
68    N=20       :REM IF THERE ARE 20 ENTRIES
70    L=1        :REM LOWER LIMIT
80    U=N        :REM UPPER LIMIT
90 F=INT((L+U)/2)        :REM FENCE
100 READ #1 %32%F,F$     :REM READ RECORD NUMBER F
110 IF F$(1,10)=K$ THEN 200      :REM FOUND IT
120 IF L>=U THEN 180     :REM NOT HERE
130 IF F$(1,10)>K$ THEN 160      :REM TRY LOWER HALF
138 REM TRY UPPER HALF
140 L=F+1        :REM RESET LOWER LIMIT TO FENCE
150   GOTO 90
160 U=F-1        :REM RESET UPPER LIMIT TO FENCE
170   GOTO 90
180 PRINT 'CANNOT FIND ',K$
182 CLOSE #1
190 GOTO 20      :REM IN LISTING 3a
200 PRINT 'HAVE LOCATED ',K$
210 PRINT 'PHONE ',K$(24,30)
212 CLOSE #1
```

```
57 REM ************ LISTING 4b ******************
58 REM *************** CBASIC *********************
59 REM ********* SEARCH FOR NAME ****************
60 OPEN 'FRIENDS.FIL' RECL 34 AS 1
68   N=20        REM IF THERE ARE 20 ENTRIES
70   L=1         REM LOWER LIMIT
80   U=N         REM UPPER LIMIT
90 F=INT((L+U)/2)        REM FENCE
100 READ #1,F;F$
110 IF LEFT$(F$,10)=K$ THEN 200 REM FOUND IT
120 IF L>=U THEN 180     REM NOT PRESENT
130 IF LEFT$(F$,10)>K$ THEN 160 REM TRY LOWER HALF
138 REM TRY UPPER HALF
140 L=F+1        REM RESET LOWER LIMIT TO FENCE
150   GOTO 90
160 U=F-1        REM RESET UPPER LIMIT TO FENCE
170   GOTO 90
180 PRINT 'CANNOT FIND ';K$
182 CLOSE 1
190   GOTO 20    REM IN LISTING 3b
200 PRINT 'HAVE LOCATED ';K$
210 PRINT 'PHONE ';RIGHT$(F$,7)
212 CLOSE 1
```

Can we use the same method to find JOHN's address? Yes, partly. Since there is insufficient room in the records of the file "FRIENDS" to include complete addresses, we make another file called "ADDRESS," but the address records don't have to be in any particular order. Bytes 11 and 12 of JOHN's entry in "FRIENDS" can be a number which indicates which "ADDRESS" record contains JOHN's address. As an example, let us assume that each address is 36 characters. Listings 5a and 5b allow the location of the pointer "A" (or link) from JOHN's record in "FRIENDS" to the record number of his address in the file "ADDRESS," and then print the address. As an example of a further extraction of data, line 260 prints only JOHN's zip code (Z$).

If there were another file, "HARDWARE," that listed the computer hardware of each of our friends, we could similarly use bytes 15 and 16 of JOHN's entry in "FRIENDS" as a link to the record of JOHN's hardware in the "HARDWARE" file. Now, if all that we're interested in, for the moment, is BILL's hardware, we use a binary search on "FRIENDS" to find BILL, obtain BILL's link to "HARDWARE" (bytes 15, 16), and read the indicated record number from the "HARDWARE" file.

We are now manipulating 3 significant data base tools. We use "FRIENDS" not only as a file of our friends' names and phone numbers, but also as a DIRECTORY to two other files. Since "FRIENDS" is dense and ordered (alphabetical with no "empty" entries) it may be used in the rapid BINARY SEARCH. Since the DIRECTORY provides links to the appropriate records of other files, only the DIRECTORY ("FRIENDS") needs to be searched, thereby allowing the other files to which it is linked to be unordered and loose (they may be in any order and may have empty records within the file). If 10 additional files are added to the now growing data base on our friends, we don't even need to place the new links within "FRIENDS". An additional file can be created which contains dozens of links for each friend. Now only 2 bytes of JOHN's entry in "FRIENDS" is needed as a link. This single link points to JOHN's entry in the new file "LINKS" which then directs us to the appropriate record in whichever file is of interest.

```
217 REM ************ LISTING 5a ******************
218 REM ******** North Star BASIC *************
219 REM * FIND ADDRESS LINK AND PRINT ADDRESS
220 A=VAL(F$(11,12))    :REM LINK TO ADDRESS
230 OPEN #2,'ADDRESS'
240 READ #2 %38%A,A$
250 PRINT 'ADDRESS IS ',A$
260 PRINT 'ZIP CODE IS ',A$(32,36)
270 CLOSE #2
```

```
217 REM ************ LISTING 5b ******************
218 REM *************** CBASIC *******************
219 REM * FIND ADDRESS LINK AND PRINT ADDRESS
220 A=VAL(MID$(F$,11,2))    REM LINK TO ADDRESS
230 OPEN 'ADDRESS.FIL' RECL 40 AS 2
240 READ #2,A;A$
250 PRINT 'ADDRESS IS ';A$
260 PRINT 'ZIP CODE IS ';RIGHT$(A$,5)
270 CLOSE 2
```

Multiple Lists

Let us say that each record in "LINKS" contains a 12 byte string of characters, and that bytes 11 and 12 of each string contain the link to the file "FOODS." To find JOHN's favorite foods, we binary search "FRIENDS" for "JOHN" and extract his link to the file "LINKS." This gives us all of the links to JOHN's entries in all of our various files. We know that bytes 11 and 12 point to his entry in the file "FOODS" and we extract those two bytes. Using this new link as the record number we read JOHN's favorite foods from the file "FOODS."

If our list of friends numbered 1000, it would require 10 "looks" in the binary search to find "JOHN" and his link to "LINKS", one "look" at "LINKS" to find his link to "FOODS" and one "look" to read the entry of his favorite foods. A total of 12 "looks" to find our desired information out of 3 lists of 1000 entries each ("FRIENDS," "LINKS," "FOODS"). Of even more significance is the advantage that, should we wish to add an additional friend to our data base, the only list which must be rearranged is our DIRECTORY (the file "FRIENDS"), since it must always be kept ordered and dense to allow the binary search. Because of the need to rearrange "FRIENDS," it is advantageous to keep each entry as short as possible to speed the process of re-

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arranging. So we may want to put the phone numbers in a separate file and pare down each "FRIENDS" entry to only 12 bytes (10 for the name, and 2 for the link to the file "LINKS"). But for consistency, we will keep "FRIENDS" as before, with 30 bytes.

Double-Linked Lists

There is a disadvantage to our method. If we wanted to know which friends liked spaghetti, there is no way to quickly retrieve the data. This type of linked directory structure is only appropriate if we will always start with a key (name) contained in the directory. To move backward, to start with "spaghetti," for example, and then try to find the matching names of friends requires that the files be DOUBLE-LINKED. Each record in "FOODS" would contain a BACKWARD LINK to the matching record in "LINKS," which would contain a BACKWARD LINK to the matching record in "FRIENDS." Each time "FRIENDS" is rearranged in the process of adding a new name, each BACKWARD LINK in "LINKS" would need to be updated. The remainder of the list, as before, would never need to be altered when expanding the list of friends.

Now that we have a substantial framework for a useable data base, we must examine the techniques needed to construct our various files ("FRIENDS," "LINKS," "FOODS," etc.).

Directory Construction and Maintenance

The directory (the file "FRIENDS") will contain an alphabetical listing of the names of our friends and will contain, with each entry, a link to that friend's entry in our sub-directory (the file "LINKS"). Each record of "FRIENDS" will hold 30 ASCII characters: 10 for the name, and 2 for the link to "ADDRESS", 2 for the link to "LINKS", 9 undefined and 7 for the phone number. The only additional information that we will need to store is the number of entries in the directory. (This is because our directory is semi-dense; it has empty entries at the end to accommodate additional names, and we must know the record number of the last "full" entry in order to perform the binary search. If the directory were dense, we would always know the number of entries, and would have no need to store that information within the file.) In North Star BASIC it is convenient to use the first record of the file, the record length times zero, to store this datum, but since CBASIC does not provide a record at position zero, we will continue to ignore it, and instead use record #1 (the record length times one) as the record which holds our file statistics.

Since the statistics record must always be the first in the file, we will fill its first character with a blank, to insure that any sorting or sequencing operation on the directory will not alter its position. Once the directory is established, we can simply read its first record prior to searching, and from it obtain the number of filled records in the directory. On adding new names to the directory, we update this length pointer.

One further aid will be to place a record at the end of the file that will always occur last in the alphabetical listing. A string of 10 characters, all of which are character 126, "~" (7E hex), meets this need. Any sorting or sequencing operation on the directory will always place this entry, "~~~~~~~~~~" as the last entry of the file.

Listings 6a and 6b create a directory file called "FRIENDS", containing only two entries, the statistics record and the end marker. While CBASIC will dynamically allocate additional file space as needed, North Star cannot unless the file is the last one on the disk (in which case it may be dynamically DESTROYed and reCREATEd to the needed length by the program). So for North Star BASIC the directory file should be initially CREATEd with a sufficient file size to accommodate a reasonably expected number of entries. The record length will be 32 (30 + 2) for North Star and 34 (30 + 4) for CBASIC. The "LINKS" file will be set up with 6 links in each entry (it may link to as many as 6 different files). The first entry of "LINKS" will hold a pointer to the first empty record position of itself and pointers to each of 5 files yet to be defined.

Listings 6a and 6b will also create one of the data base files. The example will be the file "FOODS." It will be set up for records of 48 characters each.

Now that the skeletons of a directory, subdirectory and one data file have been created, we can turn our attention to the process of appending new entries to each of them. First, let us examine the protocol which will be used when a new name is added to the directory ("FRIENDS"). The general concepts are as follows:

1. Get the new name.
2. Find its forward link to "LINKS."
3. This link will become a part of the directory entry.
4. Search "FRIENDS" to find the right place.
5. Make room for the new entry.
6. Write the new entry into friends.

```
300 REM ********** LISTING 6a ******************
302 REM ******** North Star BASIC ***************
304 REM ****** CREATE A DIRECTORY FILE **********
310 CREATE "FRIENDS",9  :REM 9 BLOCKS LONG
320 OPEN #1,"FRIENDS"
330 E$= " 02????????"     :REM ROOM FOR 99 ENTRIES
340 E1$="~~~~~~~~~~"      :REM END MARKER
350 WRITE #1 %32*1,E$     :REM IGNORE 32*0
360 WRITE #1 %32*2,E1$    :REM WRITE END MARKER
370 CLOSE #1
380 REM ****** CREATE A SUBDIRECTORY FILE *******
390 CREATE "LINKS",3
400 E$="020101010101"     :REM EMPTY RECORD POINTERS
410 OPEN #1,"LINKS"
420 WRITE #1 %14*1,E$
430 CLOSE #1
440 REM ****** CREATE A DATA FILE ***************
450 CREATE "FOODS",12
460 RETURN       :REM WE ONLY NEED THIS ONCE


300 REM ********* LISTING 6b ********************
302 REM ********** CBASIC **********************
304 REM **** CREATE A DIRECTORY FILE *************
310 CREATE "FRIENDS.FIL" RECL 34 AS 1
330 E$= " 02????????"     REM ROOM FOR 99 ENTRIES
340 E1$="~~~~~~~~~~"      REM END MARKER
350 PRINT #1,1;E$
360 PRINT #1,2;E1$
370 CLOSE 1
380 REM ******* CREATE A SUBDIRECTORY FILE ******
390 CREATE "LINKS.FIL" RECL 16 AS 1
400 E$="020101010101"     REM EMPTY RECORD POINTERS
420 PRINT #1,1;E$
430 CLOSE 1
440 REM ******* CREATE A DATA FILE **************
450 CREATE "FOODS.FIL" AS 1
454 CLOSE 1
460 RETURN       REM WE ONLY NEED THIS ONCE
```

7. Use its position as the backward link to be placed in its "LINKS" entry.
8. Write the new "LINKS" entry.
9. Update the record count of "FRIENDS."
10. Update the "next free record" pointer of "LINKS."
11. Update all the backward links in "LINKS" since some of the "FRIENDS" entries have been moved.

Much of the work in this process involves the updating of all the backward pointers. If you will not need double-linked lists (if you don't want to be able to go from "spaghetti" backward, to find the friend's name who likes it), then this protocol can be simplified considerably by deleting steps 7 and 11. The details of each of these steps is as follows:

1. Input the name and pad it with blanks.
2. Find the next available record in "LINKS" (the value of bytes 1 and 2 of the 1st record of "LINKS").
3. Include the "LINKS" record number as the link (bytes 13 and 14) for the new entry to "FRIENDS".
4. Binary search "FRIENDS" to find the position where the new entry should be placed.
5. Move all subsequent entries of "FRIENDS" one record toward the end of the file (starting with the last record and working backwards) to make room for the new entry.
6. Write the new entry into "FRIENDS" at the position found by the search.
7. Use the record number of this new entry as the backward link (bytes 1 and 2) to be included in the entry in "LINKS".
8. Write the "LINKS" entry for the new name using asterisks to indicate link positions for which there are, as yet, no list entries.
9. Read the first "FRIENDS" entry, increment the record count (the value of bytes 2 and 3) by one, then rewrite it as the first record of "FRIENDS".
10. Read the first record of "LINKS", increment the "next free record" pointer (the value of bytes 1 and 2), then rewrite it to the first record of "LINKS".
11. Update all previous backward links in "LINKS" by starting with the "FRIENDS" entry following the new entry; read the link (bytes 13 and 14) of each "FRIENDS" entry, then find the corresponding "LINKS" entry. Read its backward link (the value of bytes 1 and 2), then increment it by one and rewrite it back to the "LINKS" file.

Each time that the numeric value of a link must be changed, it must be read as ASCII characters along with its entire accompanying record, extracted from that character string, changed to its numeric value using

```
500 REM ********** LISTING 7a ******************
502 REM ******** North Star BASIC ***************
504 REM **** ADD NEW ENTRY TO DIRECTORY *********
510 GOSUB 20     :REM GET NAME & PAD IN LISTING #3
512 REM ******* GET NEW FORWARD LINK ************
518 OPEN #1,"LINKS"
520     READ #1 %14*1,E$         :REM SPACE PNTRS
522     E=VAL(E$(1,2))  :REM E=NEXT FREE RECORD
524     CLOSE #1
530 OPEN #2,"FRIENDS"
540 REM **** SEARCH FOR PROPER POSITION *********
550 READ #2 %32*1,F$     :REM GET FILE STATISTICS
560 N=VAL(F$(2,3))       :REM NUMBER OF ENTRIES+2
570     L=1      :REM INITIAL LOWER LIMIT
580     U=N      :REM INITIAL UPPER LIMIT
590 F=INT((L+U)/2)       :REM FENCE
600     READ #2 %32*F,F$  :REM READ ENTRY AT FENCE
610     IF F$(1,10)=K$ THEN 690 :REM ALREADY PRESENT
620     IF L>=U THEN 700         :REM NOT PRESENT
630     IF F$(1,10)>K$ THEN 670 :REM TRY LOWER HALF
640     REM TRY UPPER HALF
650             L=F+1
660             GOTO 590
668     REM TRY LOWER HALF
670             U=F-1
680             GOTO 590
690 PRINT "NAME : ",K$," IS ALREADY PRESENT"
692     P=1      :REM P=1 INDICATES ALREADY PRESENT
694     GOTO 1086        :REM CLOSE #1 AND RETURN
698 REM *** WHERE SHOULD NEW ENTRY BE PLACED? ***
700     READ #2 %32*L,F$         :REM READ ENTRY AT L
710     IF F$(1,10)<K$ THEN L=L+1
716             L1=L     :REM REMEMBER NEW ENTRY #
718 REM *** MOVE ALL SUBSEQUENT ENTRIES DOWN BY ONE
720     FOR X=N TO L STEP -1     :REM START WITH LAST
730             READ #2 %32*X,F$
740             WRITE #2 %32*(X+1),F$,NOENDMARK :REM MOVE IT
750     NEXT X
760 REM *** WRITE NEW ENTRY AT RECORD L *************
770     F$=K$+"**"+E$(1,2)+"*****************"
780     WRITE #2 %32*L,F$,NOENDMARK
782 GOSUB 800    :REM NUMBER TO STRING CONVERSION
788 GOTO 820
790 REM *** CONVERT NUMB. TO STRNG AND DELETE LEAD BLANK
800     E1$=STR$(L)
810     E2$=E1$(2,LEN(E1$))      REM IF E1$(2,3) IS USED,
811       REM IT WILL GO OUT OF BOUNDS IF L IS 1 DIGIT
812 RETURN
818 REM ***** CREATE "LINKS" ENTRY *****************
820 OPEN #1,"LINKS"
830     E$=E2$+"**********"      :REM NEW LINKS ENTRY
840     WRITE #1 %14*E,E$,NOENDMARK
850 REM ***** UPDATE "FRIENDS" RECORD COUNT ********
860     READ #2 %32*1,F$
870     L=VAL(F$(2,3))   :REM GET RECORD COUNT
880     L=L+1            :REM UPDATE IT
890     GOSUB 800        :REM CONVERT TO STRNG
900     F$(2,3)=E2$      :REM RE-INSERT INTO STRING
910     WRITE #2 %32*1,F$,NOENDMARK :REM REPLACE RECORD
918 REM ***** UPDATE "LINKS" SPACE POINTER *********
920     READ #1 %14*1,E$
930     L=VAL(E$(1,2))
940     L=L+1
950     GOSUB 800
960     E$(1,2)=E2$
970     WRITE #1 %14*1,E$,NOENDMARK
980 REM **** UPDATE ALL SUBSEQUENT BACKWARD LINKS **
990   FOR X=(L1+1) TO N-1 :REM L1 IS NEW RECORD POSITION
1000    READ #2 %32*X,L$         :REM READ "FRIENDS"
1010    E=VAL(L$(13,14))         :REM GET LINK
1020    READ #1 %14*E,E$         :REM READ "LINKS" ENTRY
1030    L=VAL(E$(1,2))           :REM GET BACKWARD LINK
1040    L=L+1
1050    GOSUB 800        :REM CONVERT TO STRING
1060    E$(1,2)=E2$      :REM RE-INSERT BACKWD PNTR
1070    WRITE #1 %14*E,E$,NOENDMARK :REM REPLACE "LINKS"
1080  NEXT X
1082    P=0      :REM P=0 INDICATES SUCCESSFUL ENTRY
1084 CLOSE #1
1086 CLOSE #2
1090             RETURN
```

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the VAL function, incremented or decremented, then reconverted to ASCII characters using the STR$ function, and re-inserted into the original record string. (The STR$ function adds a leading blank to the number — for the invisible plus sign — so an additional step must remove the extra blank.) Finally, this reconstructed string is rewritten to its position in the file. The entire process described in the above protocol is presented in Listings 7a and 7b. Note also, that two additional lines (700 and 710) have been added to the binary search algorithm, to enable it to know the proper position in which to place the new entry, once it has discovered that it is not in the list. If it already exists in the list, it will be rejected.

Certain of the listings are constructed as subroutines which should be accessed by a small "control module." On return from this last listing, the control module should test the value of "P" which serves as a flag to indicate whether or not the new name was already in the directory.

Using these techniques, you should be able to construct any number of files, with any record size, and place a link to its entries into the file "LINKS." Each file will need a pointer to the next free record in that file. The header (the first record) of "LINKS" has room for several such pointers.

To add data to John's entries ("FOODS" for example), we simply do the following:

1. Locate the first free record in the file "FOODS."
2. Search "FRIENDS" to find John's entry in "LINKS."
3. Write the "FOODS" record number into John's entry in "LINKS."
4. Use the record number of his "LINKS" entry as the backward pointer to be placed in his "FOODS" entry.
5. Write his favorite foods (and the backward link) into "FOODS."
6. Increment the next-free-record pointer for "FOODS."

Separate routines will be needed to update the entries themselves (you mispelled Xerxes' name, or John finally got tired of spaghetti). Since the entry already exists, you need not create one, and as a result, you need not update any pointers. A correction is accomplished by locating the record to be changed, reading it, then rewriting it (using the corrected entry) into the same file record.

```
500 REM ************ LISTING 7b ******************
502 REM ************** CBASIC ********************
504 REM **** ADD NEW ENTRY TO DIRECTORY *********
510 GOSUB 20    REM GET NAME & PAD IN LISTING #3
512 REM ******* GET NEW FORWARD LINK *************
518 OPEN "LINKS.FIL" RECL 16 AS 1
520     READ #1,1;E$                REM SPACE PNTRS
522     E=VAL(LEFT$(E$,2)) REM E=NEXT FREE RECORD
524     CLOSE 1
530 OPEN "FRIENDS.FIL" RECL 34 AS 2
540 REM **** SEARCH FOR PROPER POSITION *********
550 READ #2,1;F$            REM GET FILE STATISTICS
560 N=VAL(MID$(F$,2,2)) REM NUMBER OF ENTRIES+2
570     L=1     REM INITIAL LOWER LIMIT
580     U=N     REM INITIAL UPPER LIMIT
590 F=INT((L+U)/2)      REM FENCE
600     READ #2,F;F$    REM READ ENTRY AT FENCE
610     IF LEFT$(F$,10)=K$ THEN 690 REM ALREADY PRESENT
620     IF L>=U THEN 700        REM NOT PRESENT
630     IF LEFT$(F$,10)>K$ THEN 670 REM TRY LOWER HALF
640     REM TRY UPPER HALF
650             L=F+1
660             GOTO 590
668     REM TRY LOWER HALF
670             U=F-1
680             GOTO 590
690 PRINT "NAME : "+K$+" IS ALREADY PRESENT"
692     P=1     REM P=1 INDICATES ALREADY PRESENT
694     GOTO 1086       REM CLOSE 2 AND RETURN
698 REM *** WHERE SHOULD NEW ENTRY BE PLACED? ***
700     READ #2,L;F$                REM READ ENTRY AT L
710     IF LEFT$(F$,10)<K$ THEN L=L+1
716             L1=L    REM REMEMBER NEW ENTRY #
718 REM *** MOVE ALL SUBSEQUENT ENTRIES DOWN BY ONE
720     FOR X=N TO L STEP -1    REM START WITH LAST
730             READ #2,X;F$
740             PRINT #2,(X+1);F$       REM MOVE IT
750     NEXT X
760 REM *** WRITE NEW ENTRY AT RECORD L *************
770     F$=K$+"**"+LEFT$(E$,2)+"****************"
780     PRINT #2,L;F$
782 GOSUB 800   REM NUMBER TO STRING CONVERSION
788 GOTO 820
790 REM *** CONVERT NUMB. TO STRNG AND DELETE LEAD BLANK
800     E2$=STR$(L)     REM CBASIC DOES NOT PRODUCE A
809             REM LEADING BLANK WITH STR$ CONVERSION.
810             REM OTHER BASIC MAY ADD THE BLANK AND NEED
811             REM     E2$=MID$(STR$(L),2,2)
812 RETURN
818 REM ***** CREATE "LINKS" ENTRY *****************
820 OPEN "LINKS.FIL" RECL 16 AS 1
830     E$=E2$+"**********"     REM NEW LINKS ENTRY
840     PRINT #1,E;E$
850 REM ***** UPDATE "FRIENDS" RECORD COUNT ********
860     READ #2,1;F$
870     L=VAL(MID$(F$,2,2))  REM GET RECORD COUNT
880     L=L+1           REM UPDATE IT
890     GOSUB 800       REM CONVERT TO STRNG
900     F$=" "+E2$+MID$(F$,4,27) REM RE-INSERT
910     PRINT #2,1;F$   REM REPLACE RECORD
918 REM ***** UPDATE "LINKS" SPACE POINTER *********
920     READ #1,1;E$
930     L=VAL(MID$(E$,1,2))
940     L=L+1

950     GOSUB 800
960     E$=E2$+MID$(E$,3,10)
970     PRINT #1,1;E$
980 REM **** UPDATE ALL SUBSEQUENT BACKWARD LINKS **
990   FOR X=(L1+1) TO N-1 REM L1 IS NEW RECORD POSITION
1000    READ #2,X;L$            REM READ "FRIENDS"
1010    E=VAL(MID$(L$,13,2))    REM GET LINK
1020    READ #1,E;E$            REM READ "LINKS" ENTRY
1030    L=VAL(LEFT$(E$,2))      REM GET BACKWARD LINK
1040    L=L+1
1050    GOSUB 800       REM CONVERT TO STRING
1060    E$=E2$+MID$(E$,3,10) REM RE-INSERT BACKWD PNTR
1070    PRINT #1,E;E$           REM REPLACE "LINKS" ENTRY
1080  NEXT X
1082    P=0             REM NEW ENTRY HAS BEEN COMPLETED
1084 CLOSE 1
1086 CLOSE 2
1090            RETURN
```

Efficient Directory Management

You may have realized by now that, though the searching functions of this data base structure are extremely rapid, file updating is somewhat complex and fairly slow. This is particularly noticeable when first creating the data base, or when adding a large number of items or entries at the same sitting. This process can be accelerated considerably by reducing the number of disk reads and disk writes.

In the act of adding one new name to the directory "FRIENDS" we must read and then write each directory entry which is further down the alphabet than our new entry. If there are 50 entries in the directory, then on the average we will have to move 25 of them. If we add 10 names to the directory, we'll need over 250 moves. This problem can be remedied by the following procedure:

1. Allow the input of a number of new entries (10 or 20 for example) prior to storing them in the disk file.
2. Sort the new entries so that they are ordered (the Shell sort is probably the best choice — see Dwyer and Critchfield in SUGGESTED READINGS below).
3. Search the directory to find the proper position for the first of the new entries.
4. Now move all subsequent entries of the directory down by as many record positions as there are new entries (e.g., if there are 20 new entries, move all the subsequent old entries down 20 records toward the end of the file).
5. Perform a merge by comparing the top entries of the two lists (the new entries and the old entries which have been moved). Whichever should be placed earlier in the list is moved into the first open entry (the holes created when the old entries were moved).
6. Update each backward pointer in "LINKS" as each old entry is placed back in the directory. Increment it by the number of new entries which have already been merged. If it is a new entry, then create its "LINKS" entry.
7. Repeat 5 and 6.
8. The endpoint is when all new entries have been merged into the directory.
9. Update the backward link of any directory entry which was not moved during the merge, incrementing it by the number of new entries.
10. Update all file pointers by the number of new entries.

If we start with 50 entries and add 10 new ones, we will need to move, on the average, half of them once (25), and then move half of those (13) back again during the merge, for a total of 38 moves (compared to over 250 if each new entry is placed individually). If only one new entry will be placed, the process becomes identical to the single insertion method.

Summary

By constructing a data base system in which unordered lists are all linked, either directly or indirectly, to a single ordered list (or directory) a binary search algorithm may be used to rapidly access data. The directory list must be ordered and dense and must be re-ordered when adding new entries. All other lists need not be ordered or dense and need not be manipulated when adding new entries. □

We are what we do;
consequently,
excellence is not an act
but a habit.
Aristotle

Suggested Reading

1. Coan JS: **ADVANCED BASIC: Applications and Problems.** Hayden, 1976, ch 4 (Files).
2. Dwyer TA, Critchfield M: **BASIC AND THE PERSONAL COMPUTER.** Addison-Wesley, 1978, pp 196-229 and 324-361.
3. Flores I: **DATA STRUCTURE AND MANAGEMENT.** 2nd ed. Prentice-Hall, 1977.

Acknowledgement

The author wishes to acknowledge the continuing support of Children's Hospital Medical Center of Northern California in the development of microcomputer applications in health care.

If you don't do it excellently, don't do it at all. Because if it's not excellent, it won't be profitable or fun, and if you're not in business for fun or profit, what the hell are you doing here?
Robert Townsend
Up the Organization

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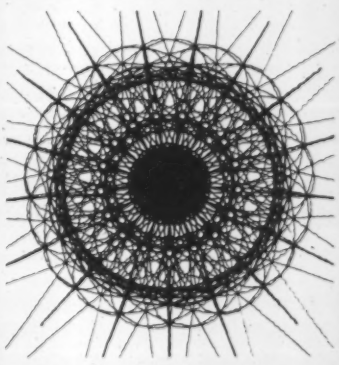

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by Julius Guest

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CIRCLE 104 ON READER SERVICE CARD

You have just updated the PAYROLL file for your 100 employees when you realize the time cards you're using are the wrong ones. You also realize that you didn't make a copy of the PAYROLL file before updating it! The only thing to do is update again to delete the changes you just made — and hope that you don't make any mistakes. You make a note to remind yourself to copy the file before updating it — next time.

Maybe the update was made correctly and the program worked as it should, but what if there was a power failure in the middle of updating the file? Or there might have been a temporary malfunction during the update which made the file unreadable in the subsequent run. In either of these cases, if you did not make a back-up file, the only recourse you have is to try to reconstruct the file, and vow that you will never again forget to make a back-up.

Automatic Backups

Your program should prepare for these eventualities by retaining the current file as back-up and creating a new file containing the changes. The only requirement is that you tell the program the names of the current file and the one which will contain the updated data. Specifying the names correctly is a snap — if you can find the listing from the previous update run.

For example, you may have specified the input file as PAYROLL1 and the output file as PAYROLL2 in the previous run. Then, for this run, the input file is PAYROLL2 and the output file is PAYROLL1. You must keep accurate records of each run so that you specify the correct names for input and output. If you correctly specify PAYROLL2 and input and PAYROLL1 as output then everything is fine. But if you inadvertently reverse the names, you will have lost the update from the previous run.

This article discusses a file handling method which takes care of retaining the back-up file automatically. It also eliminates the need for the operator to know the names of the input and output files. This method will "tell" the program the correct file names without any operator intervention. The operator will know the file simply by a generic name (e.g., "PAYROLL").

Back-up files help to insulate you from system problems and help you to recover from such problems as FILE LINK errors, DISK I/O errors and problems caused by power failures. The following technique will provide this necessary protection automatically without operator intervention.

How Is It Done?

It will be necessary to create three files to implement this method. However, the program will "know" them by a single (generic) name. To illustrate, suppose that you want to create a file called "PAYROLL." For this method you must create files called "PAYROLL," "PAYROLL1" and "PAYROLL2." Your program will only "know" the name "PAYROLL" but your data will actually be stored in the other two files.

The file with the generic name is the master file, and it contains only the names of the two data files. The order of occurrence of the names in the master file determines which data file is the most current and which is the back-up. In the above example, "PAYROLL" is the master file and "PAYROLL1" and "PAYROLL2" are the data files. Program A demonstrates how this system of files would be initialized (also see Figure 1).

Irwin Doliner, Interactive Data Systems, P.O. Box 290, Owings Mills, MD 21117.

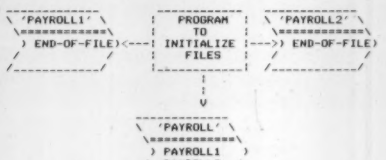

Figure 1. Initializing Files.

Program A

```
10 OPEN "O",1,"PAYROLL"      <-create master file.
20 PRINT #1,"PAYROLL1"       <-add names of
30 PRINT #1,"PAYROLL2"       <-two data files.
40 CLOSE 1                   <-close master file.
50 OPEN "O",1,"PAYROLL1"     <-create data file #1.
60 CLOSE 1                   <-close data file #1.
70 OPEN "O",1,"PAYROLL2"     <-create data file #2.
80 CLOSE 1                   <-close data file #2.
```

Thus, "PAYROLL1" is established initially as the current data file, and "PAYROLL2" as the back-up. When you run your program you will read data from the current file and write the updated data into the back-up file and then reverse the order of the names. Program B is a partial program which will demonstrate this technique (see Figure 2).

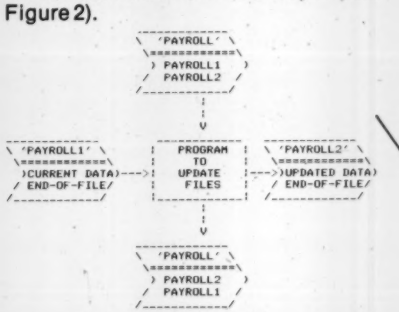

Figure 2. An Update Run.

On the next run the program will automatically be given "PAYROLL2" as the input file and "PAYROLL1" as the output file, since PAYROLL2 is first in the master file and PAYROLL1 second. The operator need never be concerned with the actual data file

Program B

```
10 OPEN "I",1,"PAYROLL"      <-open the master file.
20 INPUT #1,F1$              <-name of current file.
30 INPUT #1,F2$              <-name of backup file.
40 CLOSE 1                   <-close master file.
50 OPEN "I",1,F1$            <-open the input file.
60 OPEN "O",2,F2$            <-open the output file.
        .
        .
        .
 ------------
|            |
|   coding   |
|     to     |
|     do     |
|     the    |
|  required  |
|   updates  |
|------------|
        .
        .
        .
1000 CLOSE 1                 <-close input file.
1010 CLOSE 2                 <-close output file.
1020 OPEN "O",1,"PAYROLL"    <-open master for output.
1030 PRINT #1,F2$            <-reverse the order of
1040 PRINT #1,F1$            <-the data file names.
1050 CLOSE 1                 <-close master file.
```

names and is, thus, less concerned with the workings of the computer.

The hypothetical problems posed at the beginning of this article could have been solved very simply if this method had been employed. The incorrect update would have been "undone" effectively by merely reversing the order of the file names in the master file. This restore function could have been accomplished with coding similar to that in Program C. (Figure 3 is a flowchart of the program.)

Figure 3. File Restoral (Deleting The Last Update).

Program C

```
1000 OPEN "I",1,"PAYROLL"
1010 INPUT #1,F1$
1020 INPUT #1,F2$
1030 CLOSE 1
1040 OPEN "O",1,"PAYROLL"
1050 PRINT #1,F2$
1060 PRINT #1,F1$
1070 CLOSE 1
```

One way to improve the usefulness of this method is to make the file handling method a subroutine and use a variable for the name of the master file. For example, your program would pass the name of the master file to the subroutine as follows:

```
100 M$="PAYROLL"
110 GOSUB 32000
        .
        .
        .
32000 OPEN "I",1,M$
32010 INPUT #1,F1$
32020 INPUT #2,F2$
32030 CLOSE 1
32040 OPEN "I",1,F1$
32050 OPEN "O",2,F2$
32060 RETURN
```

Summary

You may become very inventive with this method. There is no reason why the master file may only contain the names of the data files. You might wish to include the date that each update was made, the initials of the operator who made it, or the total number of updates made so far.

What is most important about this method is the human engineering aspect it will lend to your programs. It allows the operator to concentrate on the function he is trying to perform and not on the way that the computer operates to help him perform it. □

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CIRCLE 120 ON READER SERVICE CARD

Do you have trouble keeping track of those programs for your North Star system?

Program Locator/File Package

Paul Lamb

A friend dropped by the other evening, saw my computer, and asked what it could do. It seemed like the perfect opportunity to demonstrate that new financial management program. Now, which disk is it stored on? Where did it go?

Sound familiar? If so, Williams Radio & TV, Inc. (Computer Division) has come to your rescue with their Program Locator/File Package. This program, written in North Star BASIC, allows you to track down your programs by simply calling for a search of a data base made up of them. In a couple of seconds you would have the disk number containing the program of interest.

The Program Locator/File Package contains provisions for building the file of programs on your disks, adding a new program to the file (so the file is up to date), deleting a program from the file, changing the information about a program (even its name), printing out the contents of any disk or all the disks, and searching. This last feature appears the most useful. The program will let you search for a program by name, such as SPACTREK; or, you can search for any and all programs that start with certain characters, such as finding all programs with SPAC as the first four letters of their name (you search on SPAC*); or, even to find all programs with the initial letter of your choice (search S*).

The program comes on a disk with room at the beginning for your DOS and North Star BASIC (45 sectors, enough for Version 3 but not for Version 4), the PLOCATE program and a DATAFILE. The program loaded and executed flawlessly, and within 10 minutes I was building the file for my programs. The documentation supplied is adequate, with sufficient cautions on using the "B" (begin a new file) command (it erases the present file).

The only apparent gap in the documentation is what to do if the size you specified for your data file turns out to be too small. Actually, the program doesn't determine the file size; the only file size parameter is in the directory on the disk. And that size can be easily changed by DEleting the file and reCReating it with a larger size (this will work if the data file is the last file on the disk and directory). This could be a little tricky and maybe Williams Radio & TV were smart in not telling you that it can be done.

A couple of comments on the program. First, I dislike programs which cause my disk unit to click on and off for no apparent reason. This program would accept several entries into the file, then the next three or four entries would each produce an access to the disk, then a few more entries with no access, then an access on each of the next two or three. There was no apparent pattern, which makes it kind of spooky. I've lost the contents of a few disks when programs suddenly start "using" the disk when they aren't suppose to; and this program caused a little concern with its many accesses.

Second, the information stored by the Locator/File is which disk a program is on (important), its name (useful) and its length (who cares). As

Paul Lamb, 13101 Parson Lane, Fairfax, VA 22030.

Figure 1. Program menu and sample run of Search Routine.

```
                P R O G R A M   L O C A T O R
                -----------------------------
REVISION 2.0
VERSION- NORTH STAR  (B3)

                      PROGRAM SELECTION

          ADD A DISKETTE OR PROGRAM     - TYPE 'A'
          BEGIN A NEW PROGRAM FILE      - TYPE 'B'
          CHANGE A PROGRAM              - TYPE 'C'
          DELETE A PROGRAM              - TYPE 'D'
          PRINTOUT OF PROGRAMS ON FILE  - TYPE 'P'
          SEARCH FOR A PROGRAM          - TYPE 'S'
          END PROGRAM                   - TYPE 'E'

    YOUR SELECTION: S



               SEARCH ROUTINE
               --------------

TO END PROGRAM - TYPE 'END'

ENTER NAME OF PROGRAM TO SEARCH FOR:  CALENDAR

DISK NUMBER:  4      PROGRAM: CALENDAR    LENGTH:  20

< SEARCH COMPLETED >


ENTER NAME OF PROGRAM TO SEARCH FOR:  END
```

Figure 2. Sample run of Program Printout.

```
                PROGRAM PRINTOUT
                ----------------



DO YOU WANT PRINT CONTROL: (YES OR NO)   Y

TO END PROGRAM - TYPE 'END'

FOR COMPLETE PRINTOUT             - TYPE 'P'
TO SELECT DISKETTES FOR PRINTOUT - TYPE 'S'

YOUR SELECTION: S

ENTER DISK NUMBER FOR PRINTOUT
FOR SELECTIVE PRINTOUT OF MORE THAN ONE DISKETTE -
ENTER STARTING DISK NUMBER - COMMA - ENDING DISK NUMBER

TO END PROGRAM - TYPE 'END'


DISKETTE(S) FOR PRINTOUT: 9


DISK NUMBER:  9     PROGRAM: LIBRARY     LENGTH:  148
                    PROGRAM: MAILLIST    LENGTH:  130
                    PROGRAM: INTRATE     LENGTH:  6
                    PROGRAM: BIORTHM     LENGTH:  12
                    PROGRAM: CHEKBOOK    LENGTH:  25
                    TOTAL  :  5          TOTAL  :  323

< END OF PRINT >    TOTAL NUMBER PROGRAMS PRINTED:   5

DO YOU WANT ANOTHER PRINTOUT: (YES OR NO): N
```

I was entering my files, I discovered several programs with nice names and interesting lengths and I don't have the foggiest idea what they are. The "type" can provide some clue, but the ability to enter a remark into the data file would be a very useful addition.

For a person with a half dozen or more disks and as well organized as mine are, this program is a welcome addition. It can save many minutes of pawing thru the stack of disks, hoping that the program is annotated on the outside of the disk, trying to find that special program to show your impatient friend.

The Program Locator/File Package (#PL1NS) is available from Williams Radio & TV, Inc., Computer Division, 2062 Liberty Street, Jacksonville, Florida 32206. $20. □

Computerwocky

With Apologies to Lewis Carroll

H.B. Siegel

'Twas on-line and the octal codes
Did flip and flop among the PROM,
All flashing were the red diodes
And the terminals were calm ...

Beware the Error Bug, my RUN
Its tapes that stop, its Reads that Write,
Beware the microprocessor, and shun
the everlasting Teletype....

He called his software to Display
Long time the Fatal Error roamed,
So Video-Interfaced he stayed
And resequenced as he probed....

And, as each register lay empty
The Error Bug, with Gosubs trailing,
Recalled itself to CRT
With its color graphics flailing!

Debug, Debug, and Nand and Nor
The Programmer went Delete, Refile.
The Error Bug was now no more,
And the Program would compile!

'Twas on-line and the octal codes
Did flip and flop among the PROM,
All flashing were the red diodes
And the terminals were calm....

Win BIG!!
Contest Coming!

Creative Computing September 1979

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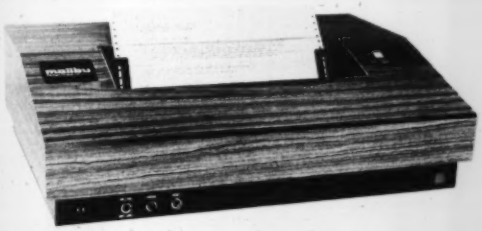

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Sorting Simplified: A Keyed String Technique

Bill Roch

Here's a sorting technique, complete with data, that you can enter into your system and experiment with.

The sort routine most often used when records need to be sorted is one which sorts each record into the proper order. This is usually unnecessary because actually all that needs to be sorted is the sort or 'key' field.

For example, suppose there are 100 records each containing 60 characters or bytes to be sorted. This means that the software has to juggle 60 character records around until they are in the proper sequence. This is time consuming no matter what kind of a sort routine is being used.

Since records to be sorted must be in an array each individual record is identified by its subscript [U$ (1) through U$ (100)]. If the sort field or key happens to be the first six characters why not just sort the six characters instead of the 60 byte record? At the same time sort the subscripts of each record into the same order as the keys. Then output the records in sorted subscript order. This routine does exactly that!

The routine sorts a user selected key and the subscript associated with that key into sequential order then prints out the records in sorted order. Naturally, these records could be written to tape cassette or to a floppy disk instead of being printed. The same principle will work with multiple field records. For example, with a five field record such as A$ (X), B(X), C(X), D(X), E$(X) just sort in key field order then output the records in sorted subscript order.

Listings of this routine and other handy routines are available from Elliam Associates, 24000 Bessemer Street, Woodland Hills, CA 91367 for only $1.00 each. □

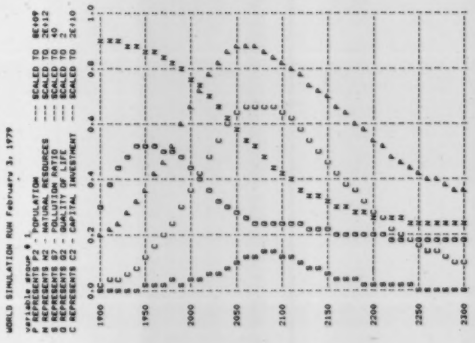
Bill Roch, 24000 Bessemer St., Woodland Hills, CA 91367.

```
LIST

100 REM ********************************
110 REM **                              **
120 REM **   STRING SORT ROUTINE        **
130 REM **     USING SORT KEYS          **
140 REM **                              **
150 REM ********************************
160 REM
170 REM  U$( ) - STRING ARRAY
180 REM  W$( ) - KEY ARRAY
190 REM  W( )  - SUBSCRIPT ARRAY
200 REM  S1    - KEY FIELD START POSITION
210 REM  L1    - KEY FIELD LENGTH
220 REM  G     - NUMBER OF RECORDS TO SORT
230 REM  T     - SORTED SUBSCRIPT
240 REM  N$    - COLUMN HEADING
250 REM  T$    - TITLE
260 REM
270 REM ****************************************
280 REM *  PROGRAM TO TEST THE SORT ROUTINE  *
290 REM ****************************************
300 PRINT "ENTER COLUMN HEADING:"
310 INPUT N$
320 REM
330 PRINT "ENTER STRING RECORDS TO BE SORTED  - END = 'END'"
340 FOR I=1 TO 50
350 INPUT U$(I)
360 IF U$(I)="END" GOTO 380
370 NEXT
380 G=I-1
390 INPUT "ENTER ID START POSN, ID LENGTH:";S1,L1
400 FOR I=1 TO G
410 W(I)=I: W$(I)=MID$(U$(I),S1,L1)
420 NEXT
430 INPUT "SORT TITLE:";T$
440 GOSUB 550:REM              CALL SORT ROUTINE
450 PRINT T$: PRINT N$
460 FOR I=1 TO G: F=W(I): PRINT U$(F): NEXT
470 INPUT "AGAIN (Y OR N):";Y$
480 IF Y$="Y" GOTO 390
490 STOP
500 REM
510 REM ********************
520 REM *  SORT ROUTINE  *
530 REM ********************
540 REM
550 C=G:C=C+1:E=1:F=1
560 PRINT:PRINT"*** NOW SORTING ***":PRINT
570 C=C/2:C=INT(C)
580 IF C=0 GOTO 670
590 D=G-C
600 FOR K=1 TO D:E=K+C:W$=W$(E):W=W(E):F=K
610 REM
620 REM >>  CHANGE FROM '<=' TO '=>' FOR DECENDING SORT
630 IF W$(F)<=W$ GOTO 660
640 E=F+C:W$(E)=W$(F):W(E)=W(F):F=F-C
650 IF F>1 GOTO 630
660 E=F+C:W$(E)=W$:W(E)=W: NEXT K: GOTO 570
670 RETURN
OK


RUN
ENTER COLUMN HEADING:
? "INV NAME    CITY      STATE ZIP  STK #  DESC        QNTY    SALE"
ENTER STRING RECORDS TO BE SORTED  - END = 'END'
? 742 JONES    COLUMBUS    OH 43212 5626-6 CASS LBLS    500    5.40
? 743 SMITH    ST LOUIS    MO 63199 4815-1 MAIL LBLS 10000   32.50
? 744 MILLER   WASHINGTON  DC 20202 4818-4 MAIL LBLS  5000   19.50
? 831 JOHNSON  BOSTON      MA 02147 5626-8 CASS LBLS  1000   49.00
? 832 ADAMS    LOS ANGELES CA 90015 8031-1 MAIL LBLS  5000   82.75
? 836 ZYPHER   ALILENE     TX 79618 5626-6 CASS LBLS 10000  395.00
? END
ENTER ID START POSN, ID LENGTH:? 5,7
SORT TITLE:? "          S O R T   BY   N A M E

*** NOW SORTING ***
```

```
          S O R T   BY   N A M E
INV NAME     CITY       STATE ZIP   STK #  DESC        QNTY   SALE
832 ADAMS    LOS ANGELESCA 90015 8031-1 MAIL LBLS  5000  82.75
831 JOHNSON  BOSTON       MA 02147 5626-8 CASS LBLS  1000  49.00
742 JONES    COLUMBUS     OH 43212 5626-6 CASS LBLS   500   5.40
744 MILLER   WASHINGTON   DC 20202 4818-4 MAIL LBLS  5000  19.50
743 SMITH    ST LOUIS     MO 63199 4815-1 MAIL LBLS 10000  32.50
836 ZYPHER   ABILENE      TX 79618 5626-6 CASS LBLS 10000 395.00
AGAIN (Y OR N):? Y
ENTER ID START POSN, ID LENGTH:? 24,2
SORT TITLE:? "           S O R T   BY   Z I P

*** NOW SORTING ***

          S O R T   BY   S T A T E
INV NAME     CITY       STATE ZIP   STK #  DESC        QNTY   SALE
832 ADAMS    LOS ANGELESCA 90015 8031-1 MAIL LBLS  5000  82.75
744 MILLER   WASHINGTON   DC 20202 4818-4 MAIL LBLS  5000  19.50
831 JOHNSON  BOSTON       MA 02147 5626-8 CASS LBLS  1000  49.00
743 SMITH    ST LOUIS     MO 63199 4815-1 MAIL LBLS 10000  32.50
742 JONES    COLUMBUS     OH 43212 5626-6 CASS LBLS   500   5.40
836 ZYPHER   ABILENE      TX 79618 5626-6 CASS LBLS 10000 395.00
AGAIN (Y OR N):? Y
ENTER ID START POSN, ID LENGTH:? 27,5
SORT TITLE:? "           SOO R T   BY   Z I P   C O D E

*** NOW SORTING ***

          S O R T   BY   Z I P   C O D E
INV NAME     CITY       STATE ZIP   STK #  DESC        QNTY   SALE
831 JOHNSON  BOSTON       MA 02147 5626-8 CASS LBLS  1000  49.00
744 MILLER   WASHINGTON   DC 20202 4818-4 MAIL LBLS  5000  19.50
742 JONES    COLUMBUS     OH 43212 5626-6 CASS LBLS   500   5.40
743 SMITH    ST LOUIS     MO 63199 4815-1 MAIL LBLS 10000  32.50
836 ZYPHER   ABILENE      TX 79618 5626-6 CASS LBLS 10000 395.00
832 ADAMS    LOS ANGELESCA 90015 8031-1 MAIL LBLS  5000  82.75
AGAIN (Y OR N):? Y


ENTER ID START POSN, ID LENGTH:? 33,6
SORT TITLE:? "           S O R T   BY   S T O C K   N O.

*** NOW SORTING ***

          S O R T   BY   S T O C K   N O.
INV NAME     CITY       STATE ZIP   STK #  DESC        QNTY   SALE
743 SMITH    ST LOUIS     MO 63199 4815-1 MAIL LBLS 10000  32.50
744 MILLER   WASHINGTON   DC 20202 4818-4 MAIL LBLS  5000  19.50
742 JONES    COLUMBUS     OH 43212 5626-6 CASS LBLS   500   5.40
836 ZYPHER   ABILENE      TX 79618 5626-6 CASS LBLS 10000 395.00
831 JOHNSON  BOSTON       MA 02147 5626-8 CASS LBLS  1000  49.00
832 ADAMS    LOS ANGELESCA 90015 8031-1 MAIL LBLS  5000  82.75
AGAIN (Y OR N):? Y
ENTER ID START POSN, ID LENGTH:? 50,10
SORT TITLE:? "   S O R T   BY   Q U N T Y   &   S A L E S

*** NOW SORTING ***

          S O R T   BY   Q U N T Y   &   S A L E S
INV NAME     CITY       STATE ZIP   STK #  DESC        QNTY   SALE
742 JONES    COLUMBUS     OH 43212 5626-6 CASS LBLS   500   5.40
831 JOHNSON  BOSTON       MA 02147 5626-8 CASS LBLS  1000  49.00
744 MILLER   WASHINGTON   DC 20202 4818-4 MAIL LBLS  5000  19.50
832 ADAMS    LOS ANGELESCA 90015 8031-1 MAIL LBLS  5000  82.75
743 SMITH    ST LOUIS     MO 63199 4815-1 MAIL LBLS 10000  32.50
836 ZYPHER   ABILENE      TX 79618 5626-6 CASS LBLS 10000 395.00
AGAIN (Y OR N):? Y
ENTER ID START POSN, ID LENGTH:? 56,6
SORT TITLE:? "           S O R T   BY   S A L E S

*** NOW SORTING ***

          S O R T   BY   S A L E S
INV NAME     CITY       STATE ZIP   STK #  DESC        QNTY   SALE
742 JONES    COLUMBUS     OH 43212 5626-6 CASS LBLS   500   5.40
744 MILLER   WASHINGTON   DC 20202 4818-4 MAIL LBLS  5000  19.50
743 SMITH    ST LOUIS     MO 63199 4815-1 MAIL LBLS 10000  32.50
831 JOHNSON  BOSTON       MA 02147 5626-8 CASS LBLS  1000  49.00
832 ADAMS    LOS ANGELESCA 90015 8031-1 MAIL LBLS  5000  82.75
836 ZYPHER   ABILENE      TX 79618 5626-6 CASS LBLS 10000 395.00
AGAIN (Y OR N):? N
```


WORLD SIMULATION

by James L. Murphy, Ph.D.



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NAT RESOURC	FOOD RATIO	NAT RESOURC USAGE
POLLUTION RATIO	LIFE EXPECTANCY	CAP INVEST RATIO
QUAL OF LIFE	BIRTH RATE	CAP INVEST RAT. AG.
CAP INVESTMENT	CROWDING RATIO	CAP INV AGRIC FRACT

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An Exciting New Era in Mathematics muMATH-78: A symbolic math system

Part I: Language capabilities

Albert D. Rich and David R. Stoutemyer

Editor's Note:
The authors have requested that wherever '78 occurs the reader read '79. There is a new version of muMath for '79; however, there are few substantial differences between muMath-79 and muMath-78.

How does computer symbolic mathematics differ from the built-in mathematical capabilities provided by traditional scientific programming languages such as ALGOL, APL, BASIC, FORTRAN, PASCAL, or PL/I? For those with previous exposure to a traditional programming language, the examples in this article quickly reveal the dramatic differences. For those with no previous programming experience, the examples reveal that no such experience is necessary.

muMath-78 is an educational tool with the capability for supporting the standard mathematics curriculum from elementary arithmetic, through algebra, trigonometry, and calculus. The system is currently implemented on an 8080-based micro system (and available on North Star, CP/M-North Star and Cromemco mini-diskettes for $165 from the Soft Warehouse). The system provides exact numerical and symbolic computation for practicing engineers, scientists, and mathematicians. It is also ideally suited for recreational mathematics, including games and puzzles which involve number theory, combinatorics, logic, and graph theory.

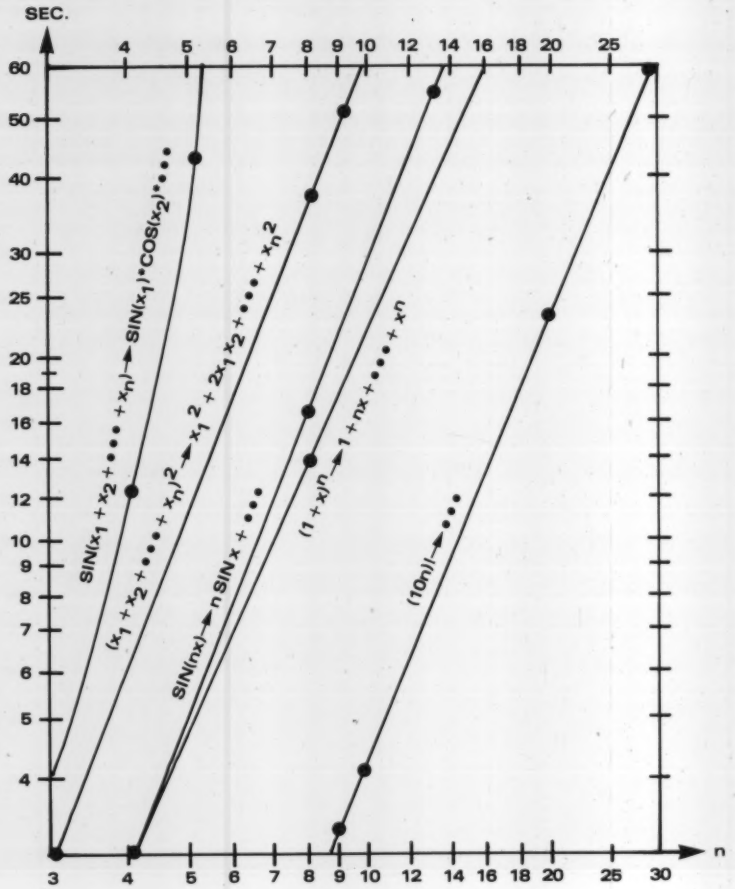


Figure 1. Execution time as a function of the number of terms.

Built-in Mathematical Capabilities

muMath-78 is interactive: The system prompts the user with a question mark, after which the user types an expression terminated by a semicolon or a dollar sign, then a carriage return. Next, the system automatically simplifies the expression. Finally, if the terminator was a semicolon, the simplified version is printed on a new line beginning with the herald " :," standing for "answer." The interaction cycle is then repeated beginning on a new line. For example, to compute 1/2 + 1/6, the user types (beginning after the question mark)

```
?1/2 + 1/6;
```

The corresponding response is

```
: 2/3
```

Note that the arithmetic is exact, without the roundoff error typical of traditional programming systems: Non-integer rational numbers are represented as ratios of integers, reduced to lowest terms.

Albert Rich, David Stoutemyer, The Soft Warehouse, P.O. Box 11174, Honolulu, HI 96828.

This result required a fraction of a second to calculate and prepare for display. (The display or print time varies greatly among terminals.) From now on we will list the computing and display-preparation time rounded to the nearest second, in braces to the right of each result.

The assignment operator, which is a colon or left arrow on most terminals, can be used to save simplified results as the values of variables, for use in subsequent expressions. For example, the symbol "↑" denotes raising to a power, so to compute 99^{99} exactly and save it as the value of the variable named WOW:

```
?WOW←99↑99;

• 369729637649726772657187905628
8805440595668764281741102430259
9724235525704552775234214106500 1
0128232727940978889548326540119 4
2999676949435945162157019364401 4
4180710606676593013849997799991 5
9200499899                    (3 sec)
```

The built-in RADIX command permits us to change the number base for both input and output to anything from 2 through 36. For example, to see what 99↑99 looks like in base 2:

```
?RADIX(2);
 1010
?WOW;                         (0 sec)

• 1001111001000110110110000000
0100100110111001001010100 1000
1110000111010001111011100 0100
0010000000001001011010000 0111
1110011101000010100010111 1000
1110000111010010011001010 0111
0001011000000010010011111 1110
1110001010000000011001000 0101
0100111010010110101011010 1001
1000110000001011111000001 0011
1110111100011111001011110 1111
1110100000000011011010010 0001
0100110101101010001100001 0001
0101110111101110000011110 1110
1001001110110111011001011 1110
0001101110100001001010010 1010
0011111101100101110010011 1110
1101011100001011011001110 1011
1000111001001010001001010 1000
1010001101110311010001101 0010
1000110010000010011001011 0000
1010101110100011010110101 0111
101111001001011 1011          (6 sec)
```

The RADIX function returns the previous base expressed in the new radix, so to change back to base 10:

```
?RADIX(1010);
 2                            (0 sec)
```

Now for a more dramatic difference from traditional programming languages: **Unbound variables** are variables to which no value has been assigned, and MICROMATH-78 permits expressions to contain such variables. For example, if X has been assigned no value and we enter the assignment

```
?WOW←3*X-X;
```

then the response is

```
 2*X                          (0 sec)
```

Note how similar terms are automatically collected. Other automatic simplifications include the collection of similar factors and the employment of identities involving 0 and 1. For example, if we now enter the expression

```
?B←WOW↑3/WOW + 1*Y↑1;
```

the response is

```
 Y + 4*X↑2                    (1 sec)
```

This example also illustrates that expressions are reordered automatically, for efficiency of collecting similar terms and factors.

Just as with most other programming systems, assignments to variables have no effect on expressions evaluated before the assignment. For example,

```
?Y←5;
 5                            (0 sec)
?B;
 Y + 4*X↑2.                   (0 sec)
```

Consequently, we have provided a function named EVAL, which forces a reevaluation of its argument:

```
?B←EVAL(B);
 5 + 4*X↑2                    (1 sec)
```

Conversely, we can use the single-quote prefix-operator to prevent evaluation of its operand. Therefore, to return Y to a virgin unbound status:

```
?Y←'Y;
 Y                            (0 sec)
```

There are numerous general algebraic transformations, and the appropriate ones depend upon the particular expressions together with the purpose of the analysis and the taste of the analyst. Consequently, only transformations which are virtually always appropriate are invariably performed. In contrast, the more drastic available transformations are optional, controlled by the values of corresponding **option variables**. For example, distribution of products over sums is controlled by the value of the variable named PRODDIST, which is initially 0:

1. If PRODDIST is a positive multiple of 2, then numeric factors are distributed over sums.
2. If PRODDIST is a positive multiple of 3, then unbound variables are distributed over sums.
3. If PRODDIST is a positive multiple of 5, then other non-sum factors which are not negative powers are distributed over sums. (Negative powers are controlled separately by a common-denominator option-variable.)
4. If PRODDIST is a positive multiple of 7, then sum factors are distributed over sums.

Since 2, 3, 5, and 7 are successive primes, assigning one of them or the product of any two, three, or all of them to PRODDIST permits us to independently request any one, two, three, or all of the four types of product distribution, as illustrated by the following examples:

```
?B←2*X*Y↑2*(3 + X)*(3-X);
 2*X*Y↑2*(3 + X)*(3-X)        (1 sec)
?PRODDIST←2$
?EVAL(B);
 X*Y↑2*(6 + 2*X)*(3-X)        (1 sec)
?PRODDIST←PRODDIST*3$
?EVAL(B);
 Y↑2*(6*X + 2*X↑2)*(3-X)      (1 sec)
?PRODDIST←PRODDIST*5$
?EVAL(B);
 (6*X*Y↑2 + 2*X↑2*Y↑2)*(3-X)
?PRODDIST←PRODDIST*7$
?B←EVAL(B);
 18*X*Y↑2-2*X↑3*Y↑2           (3 sec)
```

Where available, negative control-values generally specify the opposite of the transformations for the corresponding positive values. Thus for PRODDIST, negative multiples of 2, 3 and 5 respectively request factoring out of number, unbound variables, and other nonsums which are not negative powers, as illustrated by the example:

```
?PRODDIST←-30$
?EVAL(B);
 2*X*Y↑2*(9-X↑2)              (2 sec)
```

The entire menu of available algebraic transformations is described in the reference manual [1], so let's move on to some of the transformations available for functions: A **functional form** is an expression of the form

name (expression1, expression$_2$, ..., expression$_n$),

where $n > 0$. Expressions can contain

arbitrary functional forms. For example, we could enter the expression

```
? F(X + X) + 2*F(2*X);
```

for which the response is

```
@ 3*F(2*X)                    (1 sec)
```

Note that the arguments of functional forms are simplified, then expressions involving simplified functional forms are simplified the same as if the forms were unbound variables. Also:

1. The number of arguments need not be the same for all occurrences of a function name.
2. Functional forms can be nested.

For example, we could enter the expression

```
F( ) + F(X) + F(X,Y) + F(F(X)).
```

There are built-in automatic and optional transformations specific to some of the elementary functions of mathematics, such as the natural logarithm LN, the trigonometric sine function SIN, the trigonometric cosine function COS, and the inverse-trigonometric tangent function ATAN. Examples of associated automatic transformations include:

1. Numerical evaluation when it can be done exactly.
2. Exploitation of symmetries.
3. Exploitation of inverses.

As specified examples, muMath uses the symbol #PI to represent π, and #E to represent e, the base of the natural logarithms, so:

```
? ATAN(1);
@ #PI/4                       (0 sec)
? SIN(-X);
@ - SIN(X)                    (0 sec)
? #E↑LN(X);
@ X                           (0 sec)
```

muMath also uses the symbol #I to represent the imaginary number $+\sqrt{-1}$. Integer powers of #I are automatically reduced accordingly, as illustrated by the example:

```
? #I↑7;
@ - #I                        (0 sec)
```

The more drastic built-in elementary-function transformations are controlled by option variables. For example LNEXPAND is initially 0, but logarithms of powers are expanded into the power times the logarithm of the base when LNEXPAND is a positive multiple of 2, and logarithms of products are expanded into sums of logarithms when LNEXPAND is a positive multiple of 3, as illustrated by the dialogue:

```
? LN(2*#E↑X*Y↑3) - LN(2*Y);
@ LN(2*#E↑X*Y↑3) - LN(2*Y)(1 sec)
? LNEXPAND←6 $
? LN(2*#E↑X*Y↑3) - LN(2*Y)
@ X + 2*LN(Y)                 (2 sec)
```

An analogous option variable named TRIGEXPAND controls employment of the multiple-angle and angle-sum trigonometric identities. TRIGEXPAND is initially 0. When TRIGEXPAND is a positive multiple of 2, sines and cosines of integer multiples of angles are replaced by equivalent expressions not involving integer multiples of angles. When TRIGEXPAND is a positive multiple of 3, sines and cosines of sums are replaced by equivalent expressions not involving angle-sums. For example:

```
? TRIGEXPAND←6 $ PRODDIST
      210$
? SIN(2*Y)*(4*COS(X)↑3 - COS
(3*X)) + SIN(Y)*(COS(X + Y + #PI)
- COS(X - Y));
@ 4*SIN(Y)*COS(X)*COS(Y) (12 sec)
```

muMath-78 also supports symbolic differentiation and integration. For example, to differentiate $ax + \sin(x^2)$ with respect to x, we enter

```
? DIF (A*Y↑3 + SIN(X↑2), X);
```

and the response is

```
@ 2*X*COS(X↑2) + 3A*X↑2  (2 sec)
```

To integrate $ax^3 + xe^{x^2}$ we enter

```
? INTG(A*X↑3 + X*#E  X↑2,X);
```

and the response is

```
@ 1/4*A*X↑4 + 1/2*#E↑X↑2(3 sec)
```

Performance

How complicated can expressions be before muMath-78 exhausts the available storage space or the user's patience? The answer depends strongly upon the particular expressions, the particular transformations and the amount of space available for storing expressions. The answer also depends strongly upon individual patience: If a computer would otherwise go unused, an overnight or weekend computation may be acceptable; but for us, one minute is the acceptable order-of-magnitude time limit for an interactive computation.

What about space? muMath is organized into a hierarchy of packages, as shown in Figure 2, so that users can save space by loading only the packages they need. As indicated there, muMath-78 is implemented in muSIMP-77 , which is a Symbolic IMPlementation language especially designed for implementing interactive symbolic mathematics and other artificial-intelligence applications.

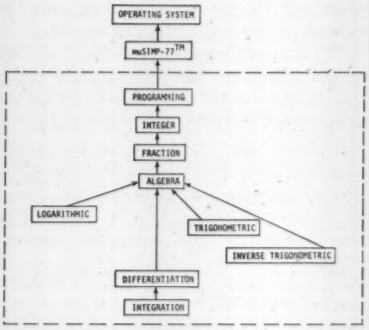


Figure 2: Organization of muMATH-78

Each package requires the prior loading of those to which it points. The amount of space available for storage of user extensions and expressions depends upon the packages which are loaded and upon the amount of contiguous random-access memory available to muSIMP-77 and muMath-78. The number of kilobytes occupied by each of these packages is given in Table 1. Regarding that table:

1. The storage for muSIMP must be at the beginning of a contiguous space which accommodates any of the other packages listed after it.
2. The size of the operating system refers to the Cromemco CDOS system. Since the operating system must merely handle console I/O and sequential I/O for some storage medium, an operating system as small as about 2 kilobytes could suffice.
3. The system has two commands for loading sequential files such as those containing the programming through integration packages. The *condensing* loader saves space at the expense of load time, by searching for and sharing instances of common subexpressions between the file being loaded and all that has been loaded before. Accordingly, sizes are listed for both techniques. (For a given system size and loaded set of packages, the condensed version tends to execute faster on the average, due to the ability to reclaim a greater amount of unused storage whenever a reclaim is necessary. Once a set

Package	Memory Type	Uncondensed			Condensed		
		Size	Subtotals	Minimum Recommended System	Size	Subtotals	Minimum Recommended System
Operating System	RAM or ROM	5.5	5.5	NA	5.5	5.5	NA
muSIMP-78	RAM or ROM	6.0	11.5	16	6.0	11.5	16
Programming	RAM	2.0	13.5	20	1.5	13.0	20
Integer	RAM	2.5	16.0	24	1.3	14.3	22
Fraction	RAM	2.4	18.4	28	1.3	15.6	24
Algebra	RAM	12.2	30.6	44	5.6	21.2	32
Logarithmic	RAM	0.7	31.3	46	0.3	21.5	33
Trigonometric	RAM	1.2	32.5	49	0.5	22.0	35
Inverse Trigonometric	RAM	0.3	32.8	50	0.1	22.1	37
Differentiation	RAM	1.0	33.8	52	0.5	22.6	38
Integration	RAM	2.3	36.1	56	1.1K	23.7	40

Table 1: Memory Requirements for muMATH-78, in Kilobytes

of packages is loaded by either technique, a memory dump can be saved so that the set can be subsequently loaded directly, by the operating system, faster than either muSIMP loader.

4. Besides space for the program, there must be space for a control stack, an atom table, strings, numbers and modes used to help represent expressions and function definitions. The amount of such workspace necessary to accomplish anything interesting increases with the number of packages loaded, so we have listed the minimum recommended system sizes, including the packages together with minimum recommended workspace sizes.

Functional Extensions

The examples shown earlier make it clear that a knowledge of computer programming is unnecessary for using the built-in capabilities of muMath. Moreover, although not all of the built-in functions and control variables were demonstrated, it is also clear that the built-in capabilities span a broad range of routine analytical operations performed by students or by practicing engineers and scientists. However, if a user desires a capability which is not built-in, then he can use one or more of the following programming techniques to implement the extension to the system:

1. function definitions,
2. rule definitions,
3. operator definitions,
4. driver modifications.

This section is concerned with the first technique.

muMath-78 consists of a high-level programming language especially designed for interactive algebraic processing, together with function definitions and property values written in that language. Together these establish the desired attributes of the primitive mathematical operators and functions such as "+", "*", LN, SIN, etc.

It will become apparent that function definitions bear a resemblance to their counterparts in traditional structured programming languages, and that the differences are due to an emphasis on expressions rather than statements: muMath is concerned with the transformation of data consisting of expressions, and expressions can be regarded as specifying procedures for the evaluation of functions. Consequently, it is highly appropriate also to have the programming language consist of expressions. Expressions have values which can be used in other expressions. **Commands** are expressions which have **side effects**. For example, an assignment command has the side effect of storing a new value for a variable. Since all commands are expressions, the assignment command has a value which can be used in other expressions, as illustrated by the example

```
P←Q←3/(R←8),
```

which leaves R with the value 8, while leaving P and Q with the value 3/8.

As illustrated previously, functional forms such as F(X) can be used even though there are no built-in transformations specific to the function name. If a user wants such an automatic transformation, then a corresponding function definition often provides the most straightforward way of implementing it. For example, since there is no built-in trigonometric tangent function, expressions of the form TAN(expression) evaluate merely to TAN(expn1), where $expn_1$ is the value of $expression_1$. Consequently, if a user wants the tangent of an expression to be replaced automatically by the ratio of the sine of the expression to the cosine of the expression, he can merely enter the function definition command:

```
FUNCTION TAN(EXPN),
  SIN(EXPN)/COS(EXPN)
  ENDFUN;
```

The immediate response is to display the name of the function, which is the value of this command, but the lasting side-effect is to employ this definition during all subsequent evaluations of tangents, unless, of course the definition is replaced by another. For example, if X is an unbound variable and the user types

```
COS(2*X)*TAN(2*X);
```

then the response is SIN(2*X).

Suppose now that a user also wants the tangent of $\pi/4$ always to be replaced automatically by 1. He could then enter the definition

```
FUNCTION TAN(EXPN),
  WHEN EXPN = #PI/4, 1 EXIT,
  SIN(EXPN)/COS(EXPN)
  ENDFUN $
```

As illustrated by these two examples:

1. The definition of a function is terminated with the word ENDFUN followed by a semicolon or a dollar sign.
2. The body of a function definition consists of a sequence of expressions which are separated by commas.
3. A **conditional exit** is an expression of the form WHEN condition, $expression_1$, expression1, ..., $expression_n$ EXIT, where $n > 0$. When the condition evaluates to FALSE, then FALSE is the value of the conditional exit, and evaluation proceeds immediately to the point following the matching word EXIT. Otherwise, evaluation branches to the

sequence of expressions between the condition and the matching EXIT rather than to any expressions following the EXIT. Any of the expressions within any conditional exit can also be conditional exits, as subsequent examples illustrate.

4. When a function definition is applied to specific arguments, the resulting value is that of the last expression or condition evaluated in the definition.

Now, suppose that for any positive integer N, we wish to expand the polynomial

(X + 1)*(X + 2)*(X + 3*...*(X + N),

where X is an unbound variable. The following function P provides a general means of doing these expansions without having to type in the entire unexpanded expression each time:

```
FUNCTION P(N),
  WHEN N = 1, X + 1 EXIT,
  (X + N)*P(N - 1)
  ENDFUN;
```

This function definition is **recursive**, because the function body refers to the function being defined. The **LOOP-expression** control-structure permits an alternative **iterative** definition of the same function:

```
FUNCTION P(N, ANS),
  % P(N) returns (X + 1)*(X + 2)*
  ...*(X + N), expanded if PROD-
  DIST is a positive multiple of
  210. ANS is a local variable. %
  ANS←X + N,
  LOOP
   WHEN N = 1, ANS EXIT,
   N←N-1,
   ANS←ANS*(X + N)
   ENDLOOP
  ENDFUN;
```

The above example contains a **comment**. A comment is a percent sign followed by a sequence of zero or more characters which are not percent signs, followed by a percent sign. A comment is an explanatory remark for human readers. Comments are ignored by muMath, so they can appear anywhere.

A sequence of expressions between the word LOOP and the matching word ENDLOOP is repeatedly evaluated until a conditional exit therein causes an exit from the loop rather than from the function which contains it. The value of the LOOP-expression is that of the conditional exit which causes termination. In this example, the loop is the last expression in the function definition, so the value of the function is the value of the loop. In general, there can be any number of conditional exits in a loop, and they can occur anywhere in the loop. Thus the FOR, WHILE, and REPEAT loops of some other languages are all essentially special cases of LOOP.

With either definition of function P, a subsequent application of the function to a positive integer argument, such as P(10), will yield the corresponding expanded polynomial, provided PRODDIST is a positive multiple of 210.

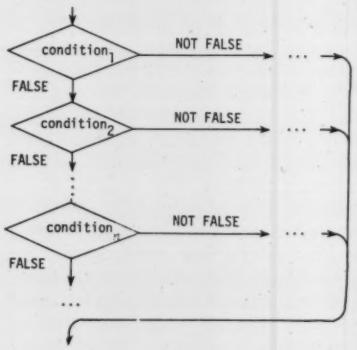
Local variables are extra parameters for which there are no corresponding arguments when the function is applied. Thus, ANS is a local variable in the iterative definition of P. **Global variables** are variables referred to in a function definition, which are not one of its parameters. Thus, X is a global variable in both definitions of P.

So far, none of the control-structures permit evaluation to take alternative paths then rejoin in the same function definition. To accomplish such rejoining, any sequence of expressions beginning with a conditional exit can be preceded by the word BLOCK and followed by a matching word ENDBLOCK, then all conditional exits in the sequence cause exit from the block rather than from any function, loop, or block which contains it.

For example, the form

```
BLOCK
  WHEN condition1, ... EXIT,
  WHEN condition2, ... EXIT,
    .
    .
    .
  WHEN conditionn, ... EXIT,
  ...
  ENDBLOCK
```

corresponds to the flow chart shown in Figure 3.



Thus, the CASE construct of some other languages is essentially a special case of the BLOCK-expression. Moreover, when $n = 1$ in this form, we have essentially the IF-THEN-ELSE construct of some other languages.

The final example in this section is the Taylor series from calculus. Those who have not studied this much calculus should skp the remainder of this section.

An n-th-degree truncated Taylor-series expansion of a sufficiently smooth function $f(x)$, about the point $x = a$, is defined as

$$f(a) + \frac{(x-a)}{1}\frac{d}{dx} f(x)\Big|_{x=a} + \frac{(x-a)^2}{2*1}\frac{d^2}{dx^2} f(x)\Big|_{x=a} + \ldots + \frac{(x-a)^n}{n*(n-1)*\ldots*1}\frac{d^n}{dx^n} f(x)\Big|_{x=a}.$$

Accordingly, here is a corresponding MICROMATH-78 function definition:

```
FUNCTION TAYLOR (EXPN,X,A,
N,J,C,ANS),
  % TAYLOR (EXPN,X,A,N) re-
  turns the Nth degree Taylor
  expansion of expression
   EXPN, expanded about X = A.
   J,C, and ANS are local vari-
   ables. %
  J←ANS←0,
  C←1,
  LOOP
   ANS ← ANS + C*EVSUB
   (EXPN,X,A),
   WHEN J = N* ANS EXIT,
   EXPN←DIF(EXPN,X),
   J←J + 1,
   C←C*(X - A)/J
   ENDLOOP
  ENDFUN;
```

The only new feature here is the built-in function named EVSUB, which returns a copy of its first argument wherein all instances of its second argument are replaced by its third argument.

As examples of the usage of this function:

```
? TAYLOR(#E ↑ X,X,0,5);
@ 1 + X + 1/2*X ↑ 2 + 1/6*X ↑ 3
  + 1/24*  X ↑ 4 + 1/120*X ↑ 5
                          (4 sec)
? TAYLOR(#E ↑ SIN(X),X,0,5);
@ 1 + X + 1/2*X ↑ 2 - 1/—*X ↑ 4 -
  1//↑*X ↑ 5          (60 sec)
```

Summary

In this first part the capabilities of muMath-78 have been discussed, along with examples. Next month, in Part II, a description of the internal representation will be covered along with a description on how to extend the built-in capabilities. These extensions are accomplished by rule extensions, parser extensions and output or driver extensions. The history of muMath-78 and the distribution policy will also be discussed. □

NICHE
A BASIC Game of Ecology

James D. Lehman

During the 1977 fall semester at Purdue University, I participated in Dr. Franz J. Frederick's Computer Assisted Instruction course. While initially quite apprehensive about this, my first encounter with the computer, it turned out to be not only informative but highly enjoyable as well. I was soon captivated by the potentials of CAI.

Background

Before long it became apparent to me that, while it might not be an educational panacea, the computer, especially the small computer, would definitely become an integral part of the classroom of the not-too-distant future. So, I began to consider ways in which the computer could be beneficially applied to the course for which I serve as graduate instructor at Purdue, Biology for Elementary School Teachers.

At the time, my course was involved in the important biological notions of ecosystem and population. Upon investigation, I found that some relevant computer applications, notably population dynamics and genetics simulations, had been done. For the most part, however, these tended to be too detailed or boring (or both) for my introductory course. Therefore, I decided to try to develop a relatively elementary game/simulation of ecological orientation.

I chose the game/simulation format because it offered a means of presenting some of the complexities of ecology in an enjoyable fashion. While the use of computer game-playing as an educational tool has been criticized, I think it is difficult to dispute its intrinsic motivational value. After all, games are fun! This, coupled with the prospect of to some extent simulating ecological processes, made the idea an attractive one.

James D. Lehman, Dept. of Biological Sciences, Purdue University, West Lafayette, IN 47907.

```
10 REM***** NICHE--AN ECOLOGICAL GAME
20 REM***** JAMES D. LEHMAN, DEPT. OF BIOLOGICAL SCIENCES
30 REM***** PURDUE UNIVERSITY, W. LAFAYETTE, INDIANA 47906
40 RANDOMIZE
50 T=0\K=0\P=100
60 $\$\$ ">>>>>>>>>>  NICHE  <<<<<<<<<<"\$
70 $ TAB(5)$"AN ECOLOGICAL GAME"\$\$\$
80 $ "WELCOME TO THE GAME OF NICHE!"
90 $ "DO YOU NEED INSTRUCTIONS (Y/N) "$
100 INPUT I$
110 ON ERROR GOTO 90
120 IF I$="N" OR I$="NO" THEN 520
130 $\$\$ "INSTRUCTIONS FOR NICHE---"\$
140 $ "NICHE REFERS TO ALL OF THE ECOLOGICAL VARIABLES WHICH"
150 $ "RELATE TO A GIVEN ORGANISM--ITS HABITAT, LIVING SPACE,"
160 $ "AND ROLE IN THE ECOSYSTEM.  IN THE GAME OF NICHE YOUR JOB"
170 $ "IS TO FIT A SELECTED ORGANISM INTO ITS NICHE.  YOU SELECT"
180 $ "ONE OF 5 ORGANISMS AND RECEIVE A SMALL POPULATION (100"
190 $ "INDIVIDUALS) OF THE ORGANISMS.  YOUR GOAL IN NICHE IS TO"
200 $ "MAXIMIZE THE SIZE OF YOUR POPULATION BY PROVIDING IDEAL"
210 $ "CONDITIONS FOR GROWTH.  AT THE BEGINNING OF THE GAME (TURN 1)"
220 $ "AND AT EACH SUBSEQUENT TURN YOU WILL INPUT THE"
230 $ "ENVIRONMENT, RANGE, AND COMPETITOR FOR YOUR POPULATION."
240 $ "ONCE DURING THE GAME, YOU MAY INPUT THE PREDATOR KILL OPTION."
250 $ "THIS WILL REDUCE BUT NOT ELIMINATE THE EFFECTS OF PREDATION"
260 $ "ON YOUR POPULATION FOR THAT TURN ONLY.  AT THE END OF EACH TURN,"
270 $ "THE FOLLOWING INFORMATION WILL BE OUTPUT:  THE AMOUNT OF"
280 $ "FOOD PRESENT IN THE RANGE, THE AMOUNT OF FOOD TAKEN BY"
290 $ "COMPETITORS, THE AMOUNT OF FOOD AVAILABLE TO YOUR POPULATION,"
300 $ "DEATHS DUE TO PREDATION, DEATHS DUE TO STARVATION AND OTHER"
310 $ "CAUSES, BIRTHS, AND THE NEW TOTAL POPULATION.  OF COURSE,"
320 $ "WHAT YOU INPUT WILL AFFECT THE RESULTS WHICH ARE OUTPUT."
330 $\$ "TO CONTINUE INSTRUCTIONS, TYPE GO"
340 INPUT G$
350 ON ERROR GOTO 330
360 IF G$<>"GO" THEN 90
370 $\$\$ "FOR INSTANCE, IF THE INPUT RANGE IS TOO SMALL FOR YOUR"
380 $ "POPULATION, THERE WILL BE INSUFFICIENT FOOD (100 UNITS PER"
390 $ "ORGANISM IS OPTIMUM) AND SOME STARVATION WILL RESULT."
400 $ "IF THE INPUT RANGE IS TOO LARGE, THERE WILL BE MANY PREDATORS"
410 $ "AND DEATHS DUE TO PREDATION WILL BE HIGH.  THE GAME LASTS"
420 $ "FOR 5 TURNS, EACH OF WHICH CORRESPONDS TO ABOUT 1 TO 2"
430 $ "GENERATIONS OF YOUR ORGANISM.  YOU SHOULD RESPOND TO INPUT"
440 $ "PROMPTS BY TYPING WHAT IS IN THE PARENTHESES FOLLOWING YOUR"
450 $ "CHOICE.  YOU MAY INITIATE EACH NEW TURN BY TYPING GO."
460 $ "GOOD LUCK!! AND, MAY THE BEST ECOLOGIST WIN!!"
480 $\$\$ "TO BEGIN THE GAME, TYPE GO"
490 INPUT G$
500 ON ERROR GOTO 480
510 IF G$<>"GO" THEN 90
520 $\$\$ "HERE WE GO!"\$\$
530 REM***** SELECTION OF THE ORGANISM
540 $ "WHAT ORGANISM---"
550 $ TAB(5)$"PARAMECIUM CAUDATUM (1)"
```

Niche con't...

The Concept

I decided to center the game around the biological concept of a niche. In ecology, a niche is the place in the scheme of things occupied by an organism. It really refers to all of the ecological variables which relate to a given organism. Thus, the niche of any one organism is dependent upon a multiplicity of interacting factors. So, the idea of a niche is one which is well suited to the capabilities of a computer.

The Game

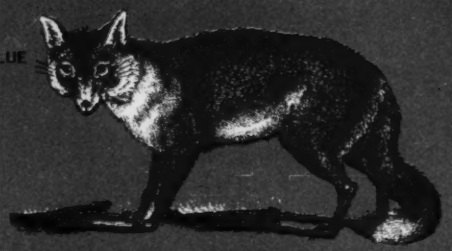
The object of the game NICHE is to fit one of five given organisms into its proper niche. The player attempts this by specifying the environment, range, and competitor for a small population of these organisms. Assuming no catastrophes, the game lasts for five generations of the organism. If conditions are well specified, the population will bountifully multiply in an ideal niche of plentiful food, low predation, and little competition. A poorly specified niche could have disastrous consequences for the population. Of course, as in a real ecosystem, the factors in NICHE are interrelated.

From a biological point of view, NICHE is not intended to be an accurate representation of an ecosystem. Rather, it is merely intended to be a fun introduction to the kinds of interactions found in real ecosystems. NICHE requires no special knowledge of biology; anyone can play!

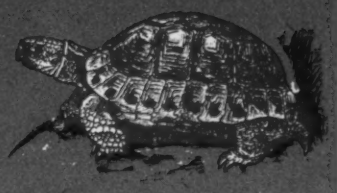
On the computing end, NICHE was designed in BASIC-PLUS to run on Purdue's PDP-11/70. However, it should run with little or no modification on most BASIC systems. Since NICHE was essentially a beginning effort, there are probably areas in the program which could be tightened up. However, I think the basic program structure is fairly sound. NICHE could be a useful part of an introductory biology program or just an interesting addition to the hobbiest's collection. Enjoy it! □

"These are the figures of the first three months..." ©Creative Computing

```
560 $ TAB(5)$"RAINBOW TROUT (2)"
570 $ TAB(5)$"ANTEATER (3)"
580 $ TAB(5)$"GRAY SQUIRREL (4)"
590 $ TAB(5)$"KANGAROO RAT (5)"
600 INPUT O
610 ON ERROR GOTO 640
630 GOTO 650
640 $ "IMPROPER RESPONSE--TRY AGAIN."\GOTO 540
650 REM**** SET UP TURN COUNTER AND PRINT TURN
660 T=T+1\$\$\$ "TURN "$T\$\$
670 REM**** SELECTION OF ENVIRONMENT
680 $ "WHAT ENVIRONMENT---"
690 $ TAB(5)$"FRESH WATER POND (P)"
700 $ TAB(5)$"FRESH WATER LAKE (L)"
710 $ TAB(5)$"TROPICAL RAIN FOREST (R)"
720 $ TAB(5)$"BOREAL CONIFEROUS FOREST (C)"
730 $ TAB(5)$"TEMPERATE DECIDUOUS FOREST (T)"
740 $ TAB(5)$"NORTH AMERICAN DESERT (D)"
750 $ TAB(5)$"TEMPERATE GRASSLAND (G)"
760 INPUT E$
770 ON ERROR GOTO 800
790 GOTO 810
800 $ "IMPROPER RESPONSE--TRY AGAIN."\GOTO 680
810 REM**** GOSUB TO SET VALUES OF E, E1, AND U$
820 GOSUB 3000
830 REM**** SELECTION OF RANGE SIZE
840 $\$\$ "WHAT RANGE FOR THE WHOLE POPULATION IN "$U$$" ---"
844 IF U$="HECTARES" THEN $ "(1 HECTARE = 10000 SQUARE METERS)"
846 IF U$="DEKASTERES" THEN $ "(1 DEKASTERE = 10 CUBIC METERS)"
850 INPUT R
860 ON ERROR GOTO 890
870 IF R<=0 THEN 890
880 GOTO 900
890 $ "IMPROPER RESPONSE--TRY AGAIN."\GOTO 840
900 REM**** SELECTION OF COMPETITOR (ORGANISM DEPENDENT)
910 REM**** AND SETTING OF TRUE OPTIMUM RANGE
920 $\$\$ "WHAT COMPETITOR---"
930 IF O=1 THEN 4000
940 IF O=2 THEN 4100
950 IF O=3 THEN 4200
960 IF O=4 THEN 4300
970 IF O=5 THEN 4400
980 REM**** GOSUB TO SET VALUES OF R1 AND R2
990 GOSUB 5000
1000 REM**** SET C1 VALUE
1010 IF C$="C" OR C$="E" OR C$="G" OR C$="I" OR C$="K" OR C$="M" THEN C1=0
1020 IF C$="B" OR C$="D" OR C$="L" OR C$="N" THEN C1=.2
1030 IF C$="F" OR C$="J" THEN C1=.4
1040 IF C$="A" OR C$="H" OR C$="O" THEN C1=.6
1050 REM**** CHECK FOR PREVIOUS USE OF PREDATOR KILL
1060 IF K=1 THEN 1140
1070 $\$\$ "PREDATOR KILL (Y/N)---"
1080 INPUT K$
1090 IF K$="Y" OR K$="YES" THEN 1120
1100 IF K$="N" OR K$="NO" THEN 1140
1110 $ "IMPROPER RESPONSE--TRY AGAIN."\GOTO 1070
1120 REM**** SET COUNTER K AND SET D1 AT A LOW LEVEL
1130 K=1 \ D1=INT(.02*P) \ GOTO 1160
1140 REM**** SET D1 AT THE NORMAL LEVEL
1150 D1=INT((.25*RND(1)+.1)*P) + INT(R2*P)
1160 REM**** SET VARIABLE VALUES
1170 R1=R/R3 \ F1=INT(100*R1*P) \ F2=INT(C1*F1)
1180 F3=F1-F2 \ F4=F3/(100*P)
1184 IF F4>1 THEN F4=1
1186 D2=INT((1-F4*E1)*P)
1190 REM**** GOSUB TO SET F5 VALUE
1200 GOSUB 6000
1210 REM**** SET BIRTHS
1220 B=INT(F5*P)
1230 IF E1=1 THEN 1250
1240 GOTO 1260
1250 B=0 \ D1=0 \ D2=P
1260 REM**** SET POPULATION
1270 P1=P \ P=P+B-D1-D2
1280 IF P<0 THEN 1300
1290 GOTO 1340
1300 X=RND(1) \ Y=RND(1)
1310 IF P1+B=INT(D1*X)+INT(D2*Y) THEN 1330
1320 GOTO 1300
1330 D1=INT(D1*X) \ D2=INT(D2*Y) \ P=P1+B-D1-D2
1340 REM**** PRINT RESULTS OF TURN
1350 $\$\$\$ "RESULTS OF TURN "$T$" ---"\$
1360 $ TAB(5)$"AMOUNT OF FOOD PRESENT IN RANGE---  "$F1$" UNITS"
1370 $ TAB(5)$"AMOUNT OF FOOD TAKEN BY COMPETITORS---  "$F2$" UNITS"
1380 $ TAB(5)$"AMOUNT OF FOOD FOR THE POPULATION---  "$F3$" UNITS"
1390 $ TAB(5)$"DEATHS DUE TO PREDATION---  "$D1
1400 $ TAB(5)$"DEATHS DUE TO STARVATION OR OTHER CAUSES---  "$D2
1410 $ TAB(5)$"BIRTHS---  "$B
1420 $\$ TAB(10)$"CURRENT POPULATION---  "$P \$\$
```



```
1430 REM***** CHECK FOR END OF GAME
1440 IF T=5 THEN 1660
1450 REM***** CHECK FOR LOSS OR GREAT REDUCTION OF THE POPULATION
1460 IF P=0 THEN 1500
1470 IF P>0 AND P<=10 THEN 1530
1480 IF P>10 AND P<=50 THEN 1560
1490 GOTO 1580
1500 ? "HEY TURKEY, YOU MANAGED TO LET YOUR POPULATION GO TO ZERO!!"
1510 ? "AND, YOU DID IT AFTER ONLY TURN "T1" !!!"
1520 GOTO 1670
1530 ? "LOOK OUT TURKEY!  YOUR POPULATION IS DOWN TO A MERE"
1540 ? P1" INDIVIDUALS!  THAT IS EXTREMELY RISKY!!!"
1550 GOTO 1580
1560 ? "YOU HAD BETTER WATCH OUT!  YOUR POPULATION IS DOWN TO"
1570 ? P1" INDIVIDUALS!  TROUBLE IS JUST AROUND THE CORNER."
1580 ? "TO BEGIN TURN "T+1" TYPE GO"
1590 INPUT Q$
1600 IF Q$<>"GO" THEN 1620
1610 GOTO 660
1620 ? "IMPROPER RESPONSE--TRY AGAIN." \ GOTO 1580
1660 REM***** FINAL PERFORMANCE EVALUATION
1670 ?\? "END OF GAME"\?\?
1680 IF P=0 THEN 1770
1690 IF P>0 AND P<=25 THEN 1800
1700 IF P>25 AND P<=100 THEN 1820
1710 IF P>100 AND P<=250 THEN 1830
1720 IF P>250 AND P<=500 THEN 1840
1730 IF P>500 AND P<=1000 THEN 1850
1740 IF P>1000 AND P<=5000 THEN 1870
1750 IF P>5000 AND P<=10000 THEN 1880
1760 IF P>10000 THEN 1900
1770 ? "YOU ARE A DISGRACE!  YOU ARE HEREBY DRUMMED OUT OF THE"
1780 ? "AMERICAN COLLEGE OF ECOLOGISTS (ACE) AND MADE A MEMBER"
1790 ? "OF THE AMERICAN SOCIETY OF STUPIDOS (YOU KNOW)!!!"\ GOTO 1920
1800 ? "THAT'S AWFUL!  THE WILDLIFE MANAGERS OF THE WORLD HAVE"
1810 ? "NOTHING BUT SPITE FOR YOU!"\ GOTO 1920
1820 ? "THAT'S VERY POOR!  I HOPE YOU DON'T OWN PETS!"\ GOTO 1920
1830 ? "THAT'S BARELY PASSABLE!  AT LEAST YOU DIDN'T LOSE ANY!"\ GOTO 1920
1840 ? "NOT BAD!  YOU ARE APPOINTED A JUNIOR ECOLOGIST!"\ GOTO 1920
1850 ? "PRETTY GOOD JOB FELLA (OR GAL)!  I GUESS WE'LL HAVE TO LET"
1860 ? "YOU JOIN THE ECOLOGIST'S CLUB!"\ GOTO 1920
1870 ? "GOOD JOB!!  YOU'RE A TRUE BLUE ECOLOGIST!"\ GOTO 1920
1880 ? "WOW!!!  TREMENDOUS JOB!  YOU CAN TAKE MARLIN PERKINS' PLACE"
1890 ? "ON WILD KINGDOM WHEN HE RETIRES!!"\ GOTO 1920
1900 ? "SUPER!!!!  SUPERB!!!!  FANTASTIC!!!!  MOTHER NATURE HERSELF"
1910 ? "MUST BE ENVIOUS!!"
1920 ?\?\? "DO YOU WANT TO PLAY ANOTHER GAME OF NICHE (Y/N)"?
1930 INPUT Q$
1940 ON ERROR GOTO 1920
1950 IF Q$="Y" OR Q$="YES" THEN 10
1960 GOTO 9999
3000 IF E$="P" THEN E=1
3010 IF E$="L" THEN E=2
3020 IF E$="R" THEN E=3
3030 IF E$="C" OR E$="T" THEN E=4
3040 IF E$="D" OR E$="O" THEN E=5
3050 IF O=1 AND O+E<4 THEN E1=0
3060 IF O=1 AND O+E>=4 THEN E1=1
3070 IF O=2 AND O+E=4 THEN E1=0
3080 IF O=2 AND O+E=3 THEN E1=.33
3090 IF O=2 AND O+E>4 THEN E1=1
3100 IF O=3 AND O+E=6 THEN E1=0
3110 IF O=3 AND O+E<>6 THEN E1=1
3120 IF O=4 AND O+E=8 THEN E1=0
3130 IF O=4 AND O+E=7 THEN E1=.33
3140 IF O=4 AND O+E>8 THEN E1=1
3150 IF O=4 AND O+E<7 THEN E1=1
3160 IF O=5 AND O+E=10 THEN E1=0
3170 IF O=5 AND O+E=9 THEN E1=.5
3180 IF O=5 AND O+E=8 THEN E1=.5
3190 IF O=5 AND O+E<8 THEN E1=1
3200 IF O=3 OR O=4 OR O=5 THEN U$="HECTARES"
3210 IF O=2 THEN U$="DEKASTERES"
3220 IF O=1 THEN U$="CUBIC CENTIMETERS"
3230 RETURN
4000 ? TAB(5)"PARAMECIUM AURELIA (A)"
4010 ? TAB(5)"AMOEBA (B)"
4020 ? TAB(5)"PARAMECIUM BURSARIA (C)"
4030 INPUT C$
4040 ON ERROR GOTO 4070
4060 GOTO 4080
4070 ? "IMPROPER RESPONSE--TRY AGAIN."\ GOTO 920
4080 R3=P \ GOTO 980
4100 ? TAB(5)"SNAPPING TURTLE (D)"
4110 ? TAB(5)"CATFISH (E)"
4120 ? TAB(5)"SOCKEYE SALMON (F)"
4130 INPUT C$
4140 ON ERROR GOTO 4170
4160 GOTO 4180
4170 ? "IMPROPER RESPONSE--TRY AGAIN."\ GOTO 920
4180 R3=2*100*P\ GOTO 980
4200 ? TAB(5)"PACA (G)"
4210 ? TAB(5)"ARMADILLO (H)"
4220 ? TAB(5)"TAPIR (I)"
4230 INPUT C$
4240 ON ERROR GOTO 4270
4260 GOTO 4280
4270 ? "IMPROPER RESPONSE--TRY AGAIN."\ GOTO 920
4280 R3=.6*P \ GOTO 980
4300 ? TAB(5)"CHIPMUNK (J)"
4310 ? TAB(5)"TURKEY (K)"
4320 ? TAB(5)"MOUSE (L)"
4330 INPUT C$
4340 ON ERROR GOTO 4370
4360 GOTO 4380
4370 ? "IMPROPER RESPONSE--TRY AGAIN."\ GOTO 920
4380 R3=.05*P \ GOTO 980
4400 ? TAB(5)"PECCARY (M)"
4410 ? TAB(5)"JACKRABBIT (N)"
4420 ? TAB(5)"POCKET MOUSE (O)"
4430 INPUT C$
4440 ON ERROR GOTO 4470
4460 GOTO 4480
4470 ? "IMPROPER RESPONSE--TRY AGAIN."\ GOTO 920
4480 R3=.1*P \ GOTO 980
5000 R1=R/R3
5010 IF R1>0 AND R1<=1.33 THEN R2=0
5020 IF R1>1.33 AND R1<=1.67 THEN R2=.05
5030 IF R1>1.67 AND R1<=2 THEN R2=.075
5040 IF R1>2 AND R1<=5 THEN R2=.1
5050 IF R1>5 AND R1<=10 THEN R2=.2
5060 IF R1>10 AND R1<=25 THEN R2=.3
5070 IF R1>25 THEN R2=.4
5080 RETURN
6000 IF F4>1 THEN F4=1
6010 IF F4=0 THEN F5=0
6020 IF F4>0 AND F4<=.25 THEN F5=.1
6030 IF F4>.25 AND F4<=.5 THEN F5=.33
6040 IF F4>.5 AND F4<=.7 THEN F5=.67
6050 IF F4>.7 AND F4<=.9 THEN F5=1
6060 IF F4>.9 AND F4<=1 THEN F5=2
6070 RETURN
9999 END
```



ALL WATCHED OVER BY MACHINES OF LOVING GRACE

I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computers
live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think
(right now, please!)
of a cybernetic forest
filled with pines and electronics
where deer stroll peacefully
past computers
as if they were flowers
with spinning blossoms.

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

– Richard Brautigan

Niche Sample Run

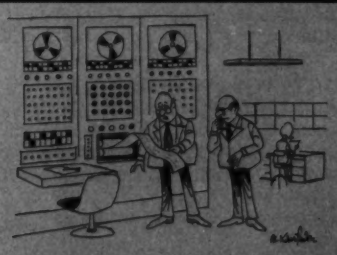
```
>>>>>>>>>>  NICHE  <<<<<<<<<<

     AN ECOLOGICAL GAME


WELCOME TO THE GAME OF NICHE!
DO YOU NEED INSTRUCTIONS (Y/N) ? Y


INSTRUCTIONS FOR NICHE---

NICHE REFERS TO ALL OF THE ECOLOGICAL VARIABLES WHICH
RELATE TO A GIVEN ORGANISM--ITS HABITAT, LIVING SPACE,
AND ROLE IN THE ECOSYSTEM.  IN THE GAME OF NICHE YOUR JOB
IS TO FIT A SELECTED ORGANISM INTO ITS NICHE.  YOU SELECT
ONE OF 5 ORGANISMS AND RECEIVE A SMALL POPULATION (100
INDIVIDUALS) OF THE ORGANISMS.  YOUR GOAL IN NICHE IS TO
MAXIMIZE THE SIZE OF YOUR POPULATION BY PROVIDING IDEAL
CONDITIONS FOR GROWTH.  AT THE BEGINNING OF THE GAME (TURN 1)
AND AT EACH SUBSEQUENT TURN YOU WILL INPUT THE
ENVIRONMENT, RANGE, AND COMPETITOR FOR YOUR POPULATION.
ONCE DURING THE GAME, YOU MAY INPUT THE PREDATOR KILL OPTION.
THIS WILL REDUCE BUT NOT ELIMINATE THE EFFECTS OF PREDATION
ON YOUR POPULATION FOR THAT TURN ONLY.  AT THE END OF EACH TURN,
THE FOLLOWING INFORMATION WILL BE OUTPUT:  THE AMOUNT OF
FOOD PRESENT IN THE RANGE, THE AMOUNT OF FOOD TAKEN BY
COMPETITORS, THE AMOUNT OF FOOD AVAILABLE TO YOUR POPULATION,
DEATHS DUE TO PREDATION, DEATHS DUE TO STARVATION AND OTHER
CAUSES, BIRTHS, AND THE NEW TOTAL POPULATION.  OF COURSE,
WHAT YOU INPUT WILL AFFECT THE RESULTS WHICH ARE OUTPUT.

TO CONTINUE INSTRUCTIONS, TYPE GO
? GO

FOR INSTANCE, IF THE INPUT RANGE IS TOO SMALL FOR YOUR
POPULATION, THERE WILL BE INSUFFICIENT FOOD (100 UNITS PER
ORGANISM IS OPTIMUM) AND SOME STARVATION WILL RESULT.
IF THE INPUT RANGE IS TOO LARGE, THERE WILL BE MANY PREDATORS
AND DEATHS DUE TO PREDATION WILL BE HIGH.  THE GAME LASTS
FOR 5 TURNS, EACH OF WHICH CORRESPONDS TO ABOUT 1 TO 2
GENERATIONS OF YOUR ORGANISM.  YOU SHOULD RESPOND TO INPUT
PROMPTS BY TYPING WHAT IS IN THE PARENTHESES FOLLOWING YOUR
CHOICE.  YOU MAY INITIATE EACH NEW TURN BY TYPING GO.
GOOD LUCK!! AND, MAY THE BEST ECOLOGIST WIN!!

TO BEGIN THE GAME, TYPE GO
? GO
```

```
HERE WE GO!

WHAT ORGANISM---
     PARAMECIUM CAUDATUM (1)
     RAINBOW TROUT (2)
     ANTEATER (3)
     GRAY SQUIRREL (4)
     KANGAROO RAT (5)
? 1

TURN  1

WHAT ENVIRONMENT---
     FRESH WATER POND (P)
     FRESH WATER LAKE (L)
     TROPICAL RAIN FOREST (R)
     BOREAL CONIFEROUS FOREST (C)
     TEMPERATE DECIDUOUS FOREST (T)
     NORTH AMERICAN DESERT (D)
     TEMPERATE GRASSLAND (G)
? P

WHAT RANGE FOR THE WHOLE POPULATION IN CUBIC CENTIMETERS ---
? 50

WHAT COMPETITOR---
     PARAMECIUM AURELIA (A)
     AMOEBA (B)
     PARAMECIUM BURSARIA (C)
? B

PREDATOR KILL (Y/N)---
? N

RESULTS OF TURN  1  ---

     AMOUNT OF FOOD PRESENT IN RANGE---   5000  UNITS
     AMOUNT OF FOOD TAKEN BY COMPETITORS---   1000  UNITS
     AMOUNT OF FOOD FOR THE POPULATION---   4000  UNITS
     DEATHS DUE TO PREDATION---   22
     DEATHS DUE TO STARVATION OR OTHER CAUSES---   60
     BIRTHS---   33

          CURRENT POPULATION---   51

TO BEGIN TURN  2  TYPE GO
? GO
```

```
TURN  2

WHAT ENVIRONMENT---
     FRESH WATER POND (P)
     FRESH WATER LAKE (L)
     TROPICAL RAIN FOREST (R)
     BOREAL CONIFEROUS FOREST (C)
     TEMPERATE DECIDUOUS FOREST (T)
     NORTH AMERICAN DESERT (D)
     TEMPERATE GRASSLAND (G)
? P

WHAT RANGE FOR THE WHOLE POPULATION IN CUBIC CENTIMETERS ---
? 100

WHAT COMPETITOR---
     PARAMECIUM AURELIA (A)
     AMOEBA (B)
     PARAMECIUM BURSARIA (C)
? A

PREDATOR KILL (Y/N)---
? N

RESULTS OF TURN  2  ---

     AMOUNT OF FOOD PRESENT IN RANGE---   10000  UNITS
     AMOUNT OF FOOD TAKEN BY COMPETITORS---   6000  UNITS
     AMOUNT OF FOOD FOR THE POPULATION---   4000  UNITS
     DEATHS DUE TO PREDATION---   8
     DEATHS DUE TO STARVATION OR OTHER CAUSES---   10
     BIRTHS---   51

          CURRENT POPULATION---   84

TO BEGIN TURN  3  TYPE GO
? GO

TURN  3

WHAT ENVIRONMENT---
     FRESH WATER POND (P)
     FRESH WATER LAKE (L)
     TROPICAL RAIN FOREST (R)
     BOREAL CONIFEROUS FOREST (C)
     TEMPERATE DECIDUOUS FOREST (T)
     NORTH AMERICAN DESERT (D)
     TEMPERATE GRASSLAND (G)
? P

WHAT RANGE FOR THE WHOLE POPULATION IN CUBIC CENTIMETERS ---
? 200

WHAT COMPETITOR---
     PARAMECIUM AURELIA (A)
     AMOEBA (B)
     PARAMECIUM BURSARIA (C)
? C

PREDATOR KILL (Y/N)---
? N

RESULTS OF TURN  3  ---

     AMOUNT OF FOOD PRESENT IN RANGE---   20000  UNITS
     AMOUNT OF FOOD TAKEN BY COMPETITORS---   0  UNITS
     AMOUNT OF FOOD FOR THE POPULATION---   20000  UNITS
     DEATHS DUE TO PREDATION---   28
     DEATHS DUE TO STARVATION OR OTHER CAUSES---   0
     BIRTHS---   168

          CURRENT POPULATION---   224
```

```
TO BEGIN TURN  4  TYPE GO
? GO

TURN  4

WHAT ENVIRONMENT---
     FRESH WATER POND (P)
     FRESH WATER LAKE (L)
     TROPICAL RAIN FOREST (R)
     BOREAL CONIFEROUS FOREST (C)
     TEMPERATE DECIDUOUS FOREST (T)
     NORTH AMERICAN DESERT (D)
     TEMPERATE GRASSLAND (G)
? P

WHAT RANGE FOR THE WHOLE POPULATION IN CUBIC CENTIMETERS ---
? 250

WHAT COMPETITOR---
     PARAMECIUM AURELIA (A)
     AMOEBA (B)
     PARAMECIUM BURSARIA (C)
? C

PREDATOR KILL (Y/N)---
? Y


RESULTS OF TURN  4  ---

     AMOUNT OF FOOD PRESENT IN RANGE---   25000  UNITS
     AMOUNT OF FOOD TAKEN BY COMPETITORS---    0  UNITS
     AMOUNT OF FOOD FOR THE POPULATION---   25000  UNITS
     DEATHS DUE TO PREDATION---   4
     DEATHS DUE TO STARVATION OR OTHER CAUSES---   0
     BIRTHS---   448

          CURRENT POPULATION---   668

TO BEGIN TURN  5  TYPE GO
? GO

TURN  5

WHAT ENVIRONMENT---
     FRESH WATER POND (P)
     FRESH WATER LAKE (L)
     TROPICAL RAIN FOREST (R)
     BOREAL CONIFEROUS FOREST (C)
     TEMPERATE DECIDUOUS FOREST (T)
     NORTH AMERICAN DESERT (D)
     TEMPERATE GRASSLAND (G)
? P

WHAT RANGE FOR THE WHOLE POPULATION IN CUBIC CENTIMETERS ---
? 1000

WHAT COMPETITOR---
     PARAMECIUM AURELIA (A)
     AMOEBA (B)
     PARAMECIUM BURSARIA (C)
? C


RESULTS OF TURN  5  ---

     AMOUNT OF FOOD PRESENT IN RANGE---   99999  UNITS
     AMOUNT OF FOOD TAKEN BY COMPETITORS---    0  UNITS
     AMOUNT OF FOOD FOR THE POPULATION---   99999  UNITS
     DEATHS DUE TO PREDATION---   154
     DEATHS DUE TO STARVATION OR OTHER CAUSES---   0
     BIRTHS---   1336

          CURRENT POPULATION---   1850


END OF GAME


GOOD JOB!! YOU'RE A TRUE BLUE ECOLOGIST!

DO YOU WANT TO PLAY ANOTHER GAME OF NICHE (Y/N)? Y
```

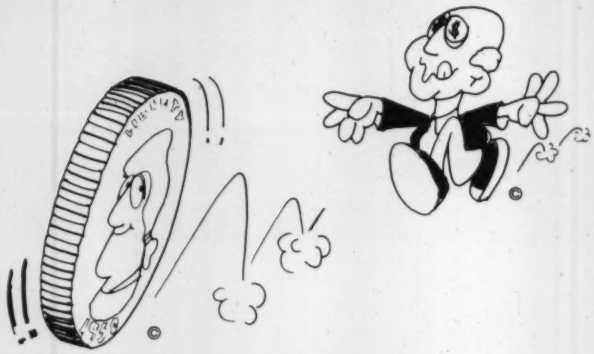
```
>>>>>>>>>>  NICHE  <<<<<<<<<<

     AN ECOLOGICAL GAME


WELCOME TO THE GAME OF NICHE!
DO YOU NEED INSTRUCTIONS (Y/N) ? N

HERE WE GO!

WHAT ORGANISM---
     PARAMECIUM CAUDATUM (1)
     RAINBOW TROUT (2)
     ANTEATER (3)
     GRAY SQUIRREL (4)
     KANGAROO RAT (5)
? 3

TURN  1

WHAT ENVIRONMENT---
     FRESH WATER POND (P)
     FRESH WATER LAKE (L)
     TROPICAL RAIN FOREST (R)
     BOREAL CONIFEROUS FOREST (C)
     TEMPERATE DECIDUOUS FOREST (T)
     NORTH AMERICAN DESERT (D)
     TEMPERATE GRASSLAND (G)

? L

WHAT RANGE FOR THE WHOLE POPULATION IN HECTARES ---
(1 HECTARE = 10000 SQUARE METERS)
? 1000

WHAT COMPETITOR---
     PACA (B)
     ARMADILLO (H)
     TAPIR (I)
? G

PREDATOR KILL (Y/N)---
? N


RESULTS OF TURN  1  ---

     AMOUNT OF FOOD PRESENT IN RANGE---   166666  UNITS
     AMOUNT OF FOOD TAKEN BY COMPETITORS---    0  UNITS
     AMOUNT OF FOOD FOR THE POPULATION---   166666  UNITS
     DEATHS DUE TO PREDATION---   0
     DEATHS DUE TO STARVATION OR OTHER CAUSES---   100
     BIRTHS---   0

          CURRENT POPULATION---   0

HEY TURKEY, YOU MANAGED TO LET YOUR POPULATION GO TO ZERO!!
AND, YOU DID IT AFTER ONLY TURN  1  !!!

END OF GAME

YOU ARE A DISGRACE!  YOU ARE HEREBY DRUMMED OUT OF THE
AMERICAN COLLEGE OF ECOLOGISTS (ACE) AND MADE A MEMBER
OF THE AMERICAN SOCIETY OF STUPIDOS (YOU KNOW)!!!

DO YOU WANT TO PLAY ANOTHER GAME OF NICHE (Y/N)? N
```



"It wants to buy us out."

©Creative Computing

Personal Finances: A Model for Planning



Dr. James Owens

The average middle-income American has only a vague comprehension of his real financial condition. Given the inherent interest in the subject, this seems surprising until one examines in detail the complexity of a middle or high-income financial life and the difficulty of "tracking" it carefully. For one thing, detailed tracking of one's personal financial condition, especially the **projecting** of past trends and present realities into a meaningful profile of the future, involves endless calculations that take too much time for the busy American. The future, particularly, is not only a gigantic financial puzzle with too many pieces but many of the pieces must be **assumed** rather than known. Typical future unknowns, for example, are inflation rate, wage increases, interest rates and taxes; typical future "knowns" (but only after thousands of calculations) are taxes at increasingly higher brackets, mortgage balances, savings and retirement pensions, etc., each of these adjusted for dozens of everchanging variables such as inflation. No wonder few busy people can fit all this into their time line. However, a computer can, given an appropriate program.

Personal Financial Condition as a System

Like any national economy, one's personal financial condition (past, present and future) is at any time a set of dozens, if not hundreds, of variables. The total effect of these variables is one's "bottom-line" (net savings and net profit). Similar, also, to a national economy, an individual's financial variables are so complex that only a computer-assisted "econometric model" can begin to cope with the complexity, changing impact of everchanging variables on each other, changing bottom-line results and, in general, the entire system of mutually-interacting "simultaneous equations." As an example, the econometric program provided in this article handles twenty-seven variables (and is capable of handling many more). A change in any one of them results in changes in all the other variables, as well as variables depending on them. To be very specific, what would be the impact on your net savings ten years hence if average inflation rate was 9% or 7% or 3% or 15% while your wages increased, respectively, by 7% or 5% or 2% or 10%, or any other of the vast number of other combinations of just these two variables?

Dr. James Owens, 12326 Riverview Rd., Washington, D.C. 20022.

The Program

This Econometric Model program, like any such model, needs inputs of two kinds of data: (1) historical (real data about the present and past); and (2) assumed (assumptions about the future). Especially important are the assumptions about the future. An econometric model is valid only to the extent that its assumptions about the future are valid. Thus this program must be updated periodically by changing the data inputs as more accurate future estimates become available. This is easily done in the program since all such changing variables can be entered (and changed) in data lines rather than in the body of the program itself. Sample data in this program (with two-character notation for the variables in parentheses below) are as follows:

Base Year Mortgage Balance (MB) = $59000

Mortgage Interest Rate (IR) = 9.25%

Annual Total of Home Mortgage Payments (Prin. + Interest) (MO) = 5923

Home Mortgage Insurance + Car Insurance (IN) = 500

Annual Life Insurance Premiums paid directly (LI) = 200

Payroll Deductions (except taxes & Social Security) (PD) = 800

Annual Social Security Premiums (SS) = 1070

Total Savings, including Cash, in Base Year (S) = 3000

Value of Home in Base Year (HO) = 65460

Total Annual Utilities, including Telephone (UT) = 1800

Food, etc. Purchased at Food Supermarkets (FO) = 3600

Annual Home Maintenance and Repair Costs (HM) = 350

Drugs incl. Cigaretts, Liquor, Prescriptions, pills, etc. (DR) = 400

Car Payments, Gasoline, Maintenance (exc. insurance) (CR) = 1500

Department Store Purchases for clothes, furniture, etc. (DS) = 3600 (Assumption: DS bills paid monthly without interest charge.)

Installment Payments annually for big items (IA) averages 2400

Real Estate Tax for Base Year (RT) = 950

Misc., incl. Recreation, Restaurants, School tuitions, etc. (MS) = 500

Gross Total Annual Income (GR) = 27400

Federal Income (IRS) Tax for Base Year (IS) = 2140

Annual Charitable Contributions (CH) = 274

Number of Tax Exemptions x $1000 (EX) = 4000

Value of Personal Property, Cars, etc. in Base Year (PP) = 9000

Annual % Increase in Wages or Salary (W) = 5%

Annual % Increase in Consumer Prices (Inflation Rate) (P) = 8%

Let Base Year = (BY) = 1977

Let Number of Years to be projected (NY) = 12

The numbers above will be different for each individual case. Just substitute correct numbers from 1977 (or other Base Year) tax records, accumulated cancelled checks by cate-

EXHIBIT I

Legend for Each Year's Information Output by "Column" Number in a Grid

(Column 1) Year 19xx	(Column 2) Gross Income	(Column 3) Fixed Expenses	(Column 4) Discretionary Expenses	(Column 5) Savings (+ or -) and Cash
(Column 6) Home Value	(Column 7) Personal Property Value	(Column 8) Home Mortgage Balance	(Column 9) Net Equity in Home	(Column 10) Total Net Worth
(Column 11) Federal (IRS) Income Tax	(Column 12) All Other Taxes (except IRS)	(Column 13) Total Tax Deductions + Exemptions	(Column 14) Taxable Income	(Column 15) Net Income After All Taxes
(Column 16) Fixed Expenses as % of Gross	(Column 17) Discretionary Exp. as % of Gross	(Column 18) All Taxes as % of Gross	(Column 19) Net Income after taxes as % of Gross	(Column 20) Increase (or decrease) in Savings as % of Base Year Savings

gories (variables) and best, recent estimates of W and P factors. (By the time this article is published, "W" could be 6% and "P" inflation factor 10% - or more!) Also, make other adjustments in the data you enter such as private pension premiums (add to "PD" or "LI") or alimony payments (which add to fixed expenses but reduce taxable income). In general, given clear identification above and in the program of variables (such as "PD" = "Payroll Deductions"), careful examination of the many, but simple, equations throughout the program help you to alter easily any of these equations to fit your case. The sample data inputs here are merely average middle-income values along with the most recent wage(W) and price (P) factors. **Note:** "Gross Income" in the program means your total income from wages and salaries. If you are in a business with business expenses, then "Gross Income" as input into the program is your total income, less business expenses, or "adjusted gross income" as calculated on the IRS tax Form 1040.

Memory Required

This program is designed to accommodate systems with as little as 4K RAM memory. When all REM program lines are deleted, a 4K system can program and output a full twelve years of econometric projections. A 20K system can project 100 years (who wants it!).

Some Program Assumptions

Many **assumptions** are necessarily built into the program as in any econometric model. The program user must evaluate these assumptions periodically to check their current validity and change them when necessary. As mentioned above, such changes have been anticipated and can be made easily in the ending data lines (Lines 800 to 1045) without touching the main program. There are some exceptions to this easy mechanical treatment of the program. If you want different "rounding-off" results, change Lines 70 or 80 which, in the current program, provide two-decimal and full integer cutoffs respectively. Other assumptions the user might wish to change: Line 270 assumes state income tax as 4% of one's gross income; Line 280 assumes state sales tax as 4% of purchases; Line 290 assumes Installment Account interest rate at 18%; Lines 350 and 360 identify items as either "Fixed Expenses" or "Discretionary Expenses" by two-character variable names; and, certainly, the user will need to change IRS tax rates periodically in Lines 560 and following.

Analysis of Program Output

After the program is keyed into the computer, a RUN will produce a four-line video display of calculated results, for as many years as desired, each line containing five elements. This produces, in effect, twenty calculated results per year arrayed into twenty "columns" but, because of the fortunate logic of current microprocessors, the twenty "columns" can be arrayed in just four lines as in Exhibit 1 (Exhibit 1 also provides a Legend identifying Variables by "column") by using a simple "comma" following the Line 760 Print statement in the program. Exhibit II shows a sample video display output of the twenty columns, for each year, for 1977 to 1981.

For the sample run in Exhibit II variables were given values (in data lines) approximating the financial life of a salaried middle-income family of four grossing $27400 with $3000 savings; anticipated annual wage increases (W) were set at W = 5% and consumer price inflation at P = 8%. The program permits many kinds of analysis toward a better understanding of one's current and future financial condition. As examples, let's look at just a few of the relationships and results produced in Exhibit II.

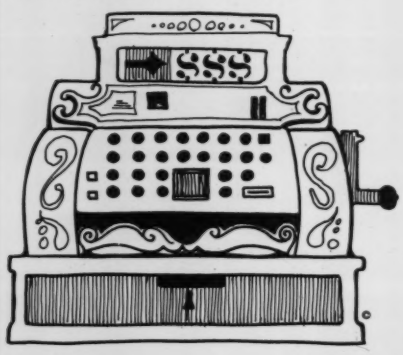
EXHIBIT II

Sample Video Display Output for Five Years (Calculations: 1977-81)

1977	27400	14829	12506	3000
65460	9000	59000	6926	18926
2140	2552	12716	14684	22708
.54	.46	.17	.83	0
1978	28770	15534	13542	2694
70697	9720	58535	12162	24576
2337	2723	13264	15506	23710
.54	.47	.18	.82	- .10
1979	30209	16261	14665	1977
76353	10498	58026	18327	30802
2560	2863	13811	16398	24786
.54	.49	.18	.82	- .34
1980	31719	17033	15881	782
82461	11338	57470	24991	37111
2790	3012	14399	17320	25917
.54	.50	.18	.82	- .74
1981	33305	17855	17198	- 966
89058	12245	56863	32195	43474
3028	3171	15032	18273	27106
.54	.52	.19	.81	- 1.32

In five years (1981) savings have been reduced from $3000 to a net $966 debt (in ten years that debt will grow to $21565) putting this family back cash-wise an average of $2000 per year. The tip-off ratio is the sum of Columns 16 and 17; when that exceeds 100%, family spending and costs exceed income. As savings becomes negative in 1981 and beyond, the family will have to "moonlight" for more income, or cut back discretionary spending (Column 4 and its component variables as listed in program line 360) or "consume" home equity and net worth (Columns 9 and 10) by borrowing against equity (usually a bad

```
10 REM  ************************************************
20 REM  ***                                            ***
30 REM  ***  PERSONAL INDIVIDUAL E C O N O M E T R I C  ***
40 REM  ***                                  M O D E L  ***
50 REM  ***  SEE DATA LINES 800-1025                   ***
60 REM  ***  FOR IDENTIFICATION OF VARIABLES.          ***
65 REM  ************************************************
70 DEF FNH(X)=INT(X*100 +.5)/100
80 DEF FNT(X)=INT(X*1   +.5)/1
100 READ MB,IR,MO,IN,LI,PD,SS,S,HO,UT,FO,HM,DR,CR,DS,IA,RT,MS
110 READ GR,IS,CH,EX,PP,W,P,BY,NY
150 DIM S(NY,20)
160 FOR R = 1 TO NY  :  S(R,1)=BY
165 BY=BY+1
170 FOR C = 2 TO 20  :  S(R,C)=0
180 NEXT C : NEXT R
200 FOR R = 1 TO 1
220 S(R,2) = GR
230 S(R,6)=HO
240 S(R,8)=FNT(MB)
250 MI = MB*IR
260 S(R,9)=FNT(S(R,6)-(MB-(MO-MI)))
270 ST=S(R,2)*.04  : REM STATE INC. TAX AS 4% OF GROSS INCOME
280 TS=(FO+UT+HM+DR+DS+IA+MS)*.04 : REM SALES TAX AT 4%
290 IT=IA*.18 : REM INTEREST PAID ON INSTALLMENT ACCOUNTS
300 S(R,13)=FNT(MI+IT+CH+ST+TS+RT+EX) : REM DEDUCTIONS+EXEMP
310 S(R,14)=S(R,2)-S(R,13)
320 S(R,11)=IS
330 S(R,5)=S
340 S(R,7)=PP
350 S(R,3)=MO+IN+LI+PD+SS+HM+ST+RT+UT+IS : REM FIXED EXPENSES
360 S(R,4)=FO+DR+CR+DS+IA+TS+MS  :  REM DISCRETIONARY EXPENSES
370 S(R,10)=S(R,5)+S(R,7)+S(R,9)
380 S(R,12)=ST+TS+RT  : REM TOTAL TAXES EXCP.  IRS TAX
390 S(R,15)=S(R,2)-(S(R,11)+S(R,12))
400 S(R,16)=S(R,3)/S(R,2)
410 S(R,17)=S(R,4)/S(R,2)
420 S(R,18)=(S(R,11)+S(R,12))/S(R,2)
430 S(R,19)=S(R,15)/S(R,2)
440 NEXT R
450 FOR R = 2 TO NY
460 S(R,2)=FNT(S(R-1,2)+(S(R-1,2)*W))
470 S(R,6)=FNT(S(R-1,6)+(S(R-1,6)*P))
480 S(R,7)=FNT(S(R-1,7)+(S(R-1,7)*P))
490 S(R,8)=FNT(S(R-1,8)-(MO-(S(R-1,8)*IR)))
500 S(R,13)=(S(R-1,13)-MI-ST)*P
505 S(R,13)=S(R,13)+(S(R-1,13)-MI-ST)
510 MI=S(R-1,8)*IR
520 ST=S(R,2)*.04
530 S(R,13)=FNT(S(R,13)+MI+ST)
540 S(R,14)=S(R,2)-S(R,13)
550 S(R,9)=S(R,6)-S(R,8)
560 REM LINES 561 ETC. = 1977 TAX RATES ON TAXABLE INCOMES
561 IF S(R,14)< 11200 THEN S(R,11)=S(R,14)*.16
562 IF S(R,14)>11199 THEN S(R,11)=1300+((S(R,14)-11199)*.22)
563 IF S(R,14)>15200 THEN S(R,11)=2260+((S(R,14)-15200)*.25)
564 IF S(R,14)>19200 THEN S(R,11)=3260+((S(R,14)-19200)*.28)
565 IF S(R,14)>23200 THEN S(R,11)=4380+((S(R,14)-23200)*.32)
566 IF S(R,14)>31200 THEN S(R,11)=7100+((S(R,14)-31200)*.39)
567 IF S(R,14)>35200 THEN S(R,11)=8660+((S(R,14)-35200)*.42)
568 IF S(R,14)>39200 THEN S(R,11)=10340+((S(R,14)-39200)*.45)
569 IF S(R,14)>43200 THEN S(R,11)=12140+((S(R,14)-43200)*.48)
570 IF S(R,14)>55200 THEN S(R,11)=18060+((S(R,14)-55200)*.55)
575 S(R,11)= FNT(S(R,11))
580 RT=RT+(RT*P)
590 S(R,12)=FNT(TS+(TS*P)+ST+RT)
600 S(R,15)=FNT(S(R,2)-S(R,11)-S(R,12))
610 S(R,19)=S(R,15)/S(R,2)
620 S(R,18)=(S(R,11)+S(R,12)) / S(R,2)
630 S(R,3)=S(R-1,3)-(MO+S(R-1,11)+S(R-1,12))
640 S(R,3)=S(R,3)+(S(R,3)*P)
650 S(R,3)=FNT(S(R,3)+MO+S(R,11)+S(R,12))
```



```
660 S(R,4)=(S(R-1,4)-FO)+((S(R-1,4)-FO)*P)
665 FO = FO + (FO*(P+ .01))
670 S(R,4)=FNT(S(R,4)+FO)
680 S(R,17)=S(R,4)/S(R,2)
690 S(R,16)=S(R,3)/S(R,2)
700 S(R,5)=S(R-1,5)+(S(R,2)-S(R,3)-S(R,4))
710 S(R,10)=S(R,5)+S(R,7)+S(R,9)
720 S(R,20)=(S(R,5)-S)/S
740 NEXT R
750 FOR R = 1 TO NY   :  FOR C = 1 TO 20
760 PRINTFNH(S(R,C)),
770 NEXT C
780 PRINT"-----------------------------------------------------
790 NEXT R
800 REM  PUT IN 805 MB = BASE YEAR MORTGAGE BALANCE
805 DATA 59000
810 REM  PUT IN 815 IR = MORTGAGE INTEREST RATE
815 DATA .0825
820 REM  PUT IN 825 MO = ANNUAL MORTGAGE PMT (P + I)
825 DATA 5923
830 REM  PUT IN 835 IN = MORTGAGE & CAR INSURANCE ANNUALLY
835 DATA 500
840 REM  PUT IN 845 LI = LIFE INS. PREMIUMS PAID DIRECTLY
845 DATA 200
850 REM  PUT IN 855 PD = PAYROLL DEDUCTIONS (EXCEPT SOCIAL
851 REM                  SECURITY AND TAX DEDUCTIONS)
855 DATA 800
860 REM  PUT IN 865 SS = ANNUAL SOC. SECURITY PREMIUMS
865 DATA 1070
870 REM  PUT IN 875  S = TOTAL SAVINGS AS OF BASE YEAR
875 DATA 3000
880 REM  PUT IN 885 HO = MARKET VALUE OF HOME IN BASE YEAR
885 DATA 65460
890 REM  PUT IN 895 UT = TOTAL ANNUAL UTILITIES, INC. PHONE
895 DATA 1800
900 REM  PUT IN 905 FO = FOOD COSTS INCL. HOUSEHOLD GOODS
901 REM                  PURCHASED AT FOOD SUPERMARKETS
905 DATA 3600
910 REM  PUT IN 915 HM = ANNUAL HOME MAINTENANCE COSTS
915 DATA 250
920 REM  PUT IN 925 DR = DRUGS INCL. PRESCRIPTIONS, LIQUOR,
921 REM                  CIGARETS, BEER, PILLS ETC.
925 DATA 400
930 REM  PUT IN 935 CR = CAR PMTS., GASOLINE, CAR UPKEEP COSTS
935 DATA 1500
940 REM  PUT IN 945 DS = DEPT. STORE PURCHASES FOR CLOTHES,
941 REM                  FURNITURE, HOUSEHOLD GOODS, ETCC
945 DATA 3600
950 REM  PUT IN 955 IA = INSTALLMENT PMTS ANNUALLY FOR
951 REM                  BIG ITEMS (FREEZER, ETC)EXC. CAR
955 DATA 2400
960 REM  PUT IN 965 RT = REAL ESTATE TAX FOR BASE YEAR
965 DATA 950
970 REM  PUT IN 975 MS = MISC INC. RECREATION, EATING OUT, ETC
975 DATA 500
980 REM  PUT IN 985 GR = GROSS TOTAL ANNUAL INCOME
985 DATA 27400
987 REM  PUT IN 988  IS = IRS TAX FOR BASE YEAR
988 DATA 2140
990 REM  PUT IN 995 CH = AMT OF CHARITABLE CONTRIBUTIONS
995 DATA 274
1000 REM PUT IN 1005 EX = NUMBER OF EXEMPTIONS  X $1000
1005 DATA 4000
1007 REM  PUT IN 1008  PP = VALUE OF PERSONAL PROPERTY, CARS, ETC
1008 DATA 2000
1010 REM PUT IN 1015  W = ANNUAL % INCREASE OF WAGES(INCOME)
1015 DATA .05
1020 REM PUT IN 1025  P = ANNUAL % INCREASE OF CONSUMER PRICES
1025 DATA .08
1030 REM  PUT IN 1035 THE BASE YEAR (1977,1978 OR 1979 ETC)
1035 DATA 1977
1040 REM  PUT IN 1045 NUMBER OF YEARS TO BE PROJECTED
1045 DATA 12
```

Finances, con't....

idea!). Note, too, the irony in Column 18 where, over five years, inflationary, not real, increases in gross income put the family into a higher tax bracket rate adding two percentage points to taxes and draining those two points from net income after taxes (Column 19). In ten years this tax point spread will be four. If you experiment with different values for W and P, P exceeding W by two points such as W = 4% and P = 6%, the financial "bind" above materializes with any combination of W and P in just about six years. On the good news side, if you let "Number of Years Projected" (NY in data line 1045) equal 30, the above family reduces its home mortgage to zero in about that number of years. Incidentally, a RUN for 30 years' video display takes 32 seconds for all calculations needed and display start (on the OSI Challenger I'm using); RAM memory needed is about 6K.

Program Modifications

Depending on each individual's personal situation, this program can easily be modified to fit the situation by merely creating new variables and adding them into the appropriate program lines. For example, you might work into the program "ME" for medical deductions, "WE" for deductible working expenses, or "BO" for additional (discretionary) spending on your boat, or "IV" for investment income. Such modifications, easily built into the standard program, are virtually infinite in their possibilities. And make the program uniquely your econometric model.

Two particularly important modifications need to be mentioned. The standard program assumes that one itemizes tax deductions. Obvious modifications are required for users who take the "standard deduction" in their tax reporting.

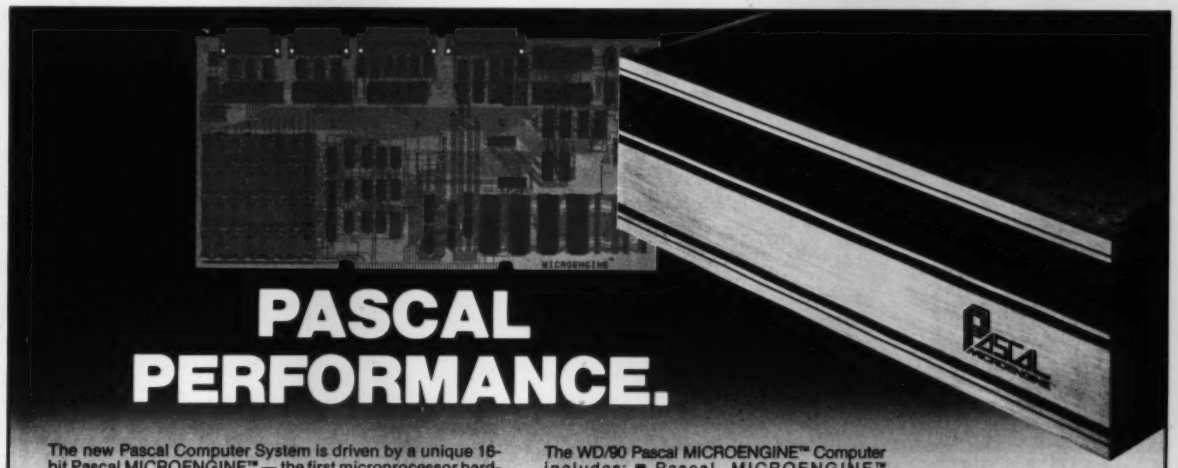
More important are the modifications required for users who rent rather than own their homes or apartments. The following program changes will adapt the program properly:

(1) Add Line 120 Read RE, and
(2) Line 355 Let S(R,3) = S(R,3) + RE
(3) Let Lines 805, 825, 885, 915 and 965 = 0
(4) Let Line 835 = Annual Car Insurance
(5) Let Line 988 = 3792 (IRS tax for Base Year)
(6) Let Line 1050 = RE = Annual Rent payments

A suggestion: if you rent, change the program as above and RUN it for a ten year projection. Print, or jot down, the twenty displayed results for each year. Then change the program back to its original conditions (involving the "own home" rather than a "rent" assumption), input realistic data regarding mortgage payments, home value, annual interest rate, original mortgage, home maintenance costs, mortgage insurance and real estate tax. Then RUN for ten years, print or jot down the results. And compare your financial life when renting versus owning a home. If your case is typical, the contrasted results will be amazing! The mortgage interest tax deduction, real estate tax deduction and other related and cumulative effects upon savings, net worth and bottom-line ratio numbers are intriguing to watch (and analyze) year by year. It could (or should) lead to new, or revised, financial decisions.

Conclusion

Good and currently valid decision-making is what econometric models are all about. Such models provide information and decisions are no better than the information they are based on. This model provides detailed information for any individual's personal financial decisions. □



PASCAL PERFORMANCE.

The new Pascal Computer System is driven by a unique 16-bit Pascal MICROENGINE™ — the first microprocessor hardware designed exclusively for direct high-level language execution. ■ The processor is incorporated into a single board computer system, the WD/90, which directly executes Pascal intermediate code generated by the University of California at San Diego (UCSD) Pascal compiler, Release III.0. ■ Since P-code output by the Pascal compiler represents an ideal architecture for a computer executing Pascal programs and since the WD/90 directly executes P-code (no interpreter), these programs execute up to five or more times faster than equivalent systems.

The WD/90 Pascal MICROENGINE™ Computer includes: ■ Pascal MICROENGINE™ processor ■ 64K bytes of RAM Memory ■ Two RS-232 asynchronous/synchronous ports (110-19.2K baud-full duplex) ■ Two 8-bit parallel ports (500 kHz maximum data rate) ■ Floppy disk controller with direct memory access (DMA), switch selectable for: single or double density (IBM format); mini or standard floppy; 1 to 4 drives (same type) ■ Floating point hardware (proposed IEEE standard) ■ Memory Mapped I/O ■ Enclosed power supply Complete UCSD Pascal Operating System (Release III.0)

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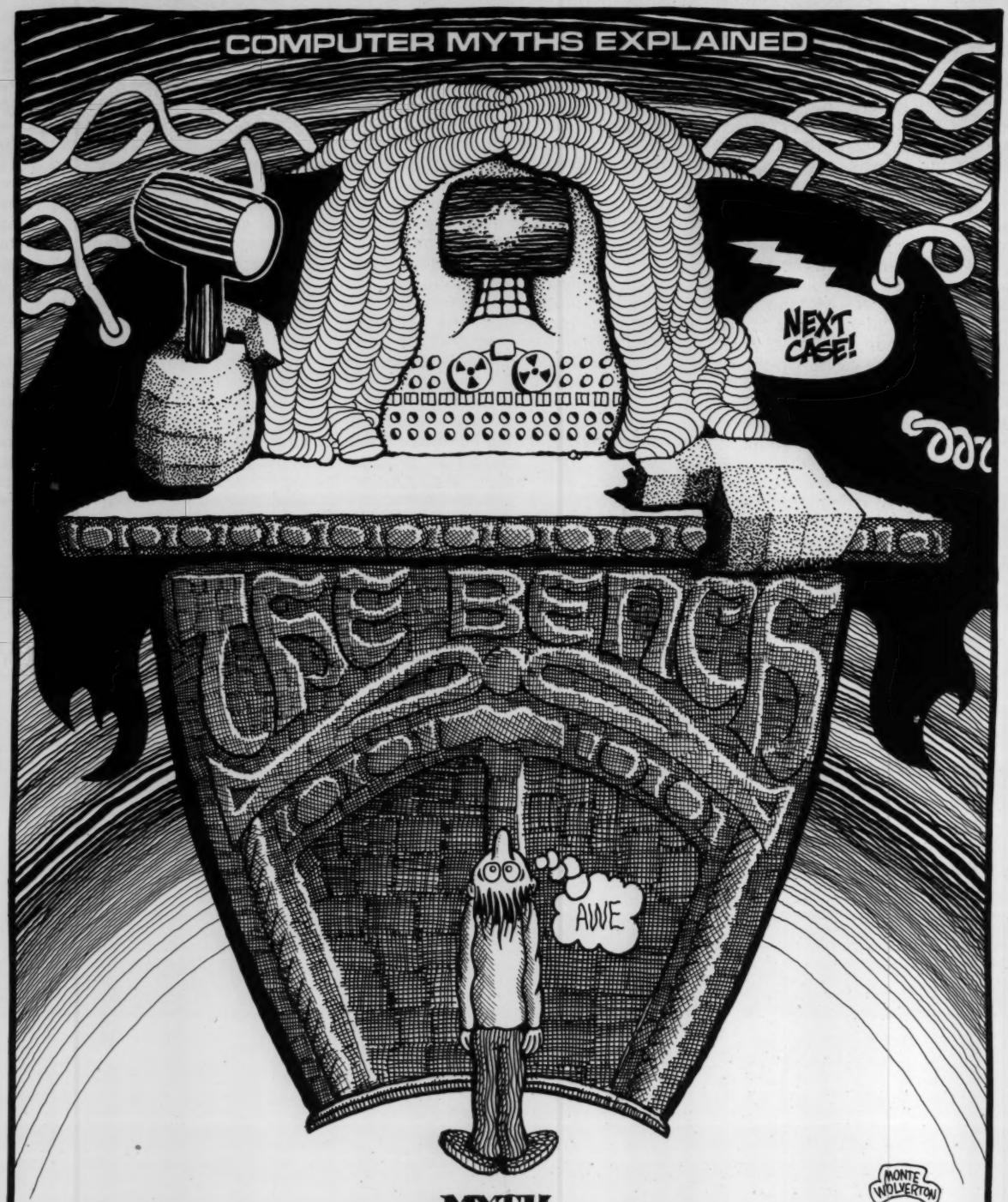
CIRCLE 192 ON READER SERVICE CARD



MYTH
THE JUDICIARY COMPUTER

COMPUTERS ARE THE ULTIMATE JUDGES OF HUMANITY'S QUESTIONS! THEY CAN PROVE OR DISPROVE THE EXISTANCE OF U.F.O.S; PREDICT THE OUTCOME OF ELECTIONS, WARS, AND GUNNYSACK RACES; AND DECIDE WHAT BUSINESS INVESTMENTS ONE SHOULD MAKE! IF YOU'RE IN DOUBT ABOUT ANYTHING, A COMPUTER ANALYSIS WILL GIVE YOU THE ANSWER! IN THE FUTURE THE SAGACIOUS, OMNISCIENT, IMPARTIAL, INFALLIBLE COMPUTER WILL BECOME MANKIND'S JUDGE, AND THE WORLD WILL ENTER A UTOPIAN ETERNITY OF "PAX COMPUTA"!

Expand your TRS-80. Save $100.

Meet the Vista V80 Mini Disk System. The perfect way to upgrade your TRS-80* system. Inexpensively. (Our $395.00 price is about $100.00 less than the manufacturer's equivalent.) Here's how it can help you.

23% more storage capacity. Useable storage is increased from 55,000 to 65,000 bytes on drive one.

8 times faster. While electronically equal to the TRS-80 Mini-Disk system, track-to-track access is 5ms versus 40ms for the TRS-80.

Better warranty. The V80 carries a 120 day warranty – longer than any comparable unit warranty available.

The Vista V80 Mini Disk System comes complete with Minifloppy disk drive, power supply, regulator board and case. And it's ready to run – simply take it out of the box, plug it in and you're ready to go. Dealer inquiries invited.

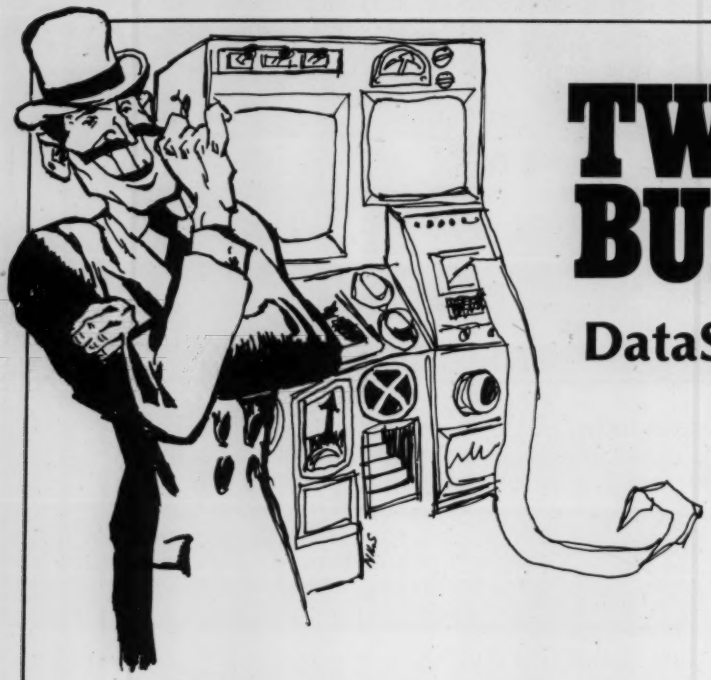
Vista

1320 East St. Andrews Place, Suite I
Santa Ana, California 92705
(714) 558-8813

At Vista, we mean business.

CIRCLE 191 ON READER SERVICE CARD

*TRS-80 ©Tandy Corp.



TWICE BURNED

DataSync & World Power Systems

John Craig

Back in the latter part of 1976 a friend of mine brought a new acquaintance of his to our local computer club meeting. The newcomer's name was David Winthrop and he was a retired Colonel from the U.S. Air Force who had recently moved into the area (Santa Maria, California). We were all left a little aghast, and very impressed, as he rattled off the equipment he had at home during our "self-introduction" session. (He had an Imsai 8080 with two terminals, and a host of other equipment and peripherals, plus, not just one disk drive - but two...all of which was rather impressive in late 1976!) However, there was more to it than just his collection of equipment...the man was impressive. His manner, his self-assurance, his easy, comfortable way of speaking to people left no doubt he had the situation in control.

Dave Winthrop and I became friends and he eventually went on to form a company called DataSync Corporation. DataSync made its first appearance before the computer hobbyist community with an ad in the June, 1977, issue of **Interface Age**. The ad had a photo of a rather pitiful looking terminal called the DS-100 ($695 kit, $795 assembled) and a 16K RAM board for $298. The same full-page ad was run in the July issue of **Byte** magazine. DataSync really came on like gangbusters with the July issue of **Interface Age** and the August issue of **Kilobaud**. Those ads were two full pages, and featured additional products along with the much-improved DS-100 terminal (improved appearance, that is). That two-page spread is shown in Photo 7. The DS-100 is shown on the far right next to one of the new products, a Monitor-I/O board with a 2K monitor in PROM, 7 RS-232 ports, 2 parallel ports and a Tarbell cassette interface. The facing page has the 16K RAM board, a new keyboard and two other, smaller interface items.

It was all a very elaborate con game. David Winthrop had never even been in the Air Force...much less a retired Colonel. As a matter of fact, David Winthrop was just one of a string of aliases he had been using over the years. His real name is Norman Henry Hunt. The DS-100 didn't exist...it was a total mock-up (the keytops weren't even glued in place, they were just laid on the wooden cabinet for the photo). The "16K RAM" board was an SD Sales 4K RAM board with SD Sales' name masked out with white tape at the bottom of the board. The Monitor-I/O board was a Polymorphics analog-to-digital board, doctored up for the photo. That one was almost laughable (except none of this was funny) because there's no way all of those features and capabilities could have been implemented on that board. For example, each of the 7 RS-232 channels would require a minimum of 13 pins each to meet the 232 spec... and the connector across the top of the board had only 44 pins! (Apparently not too many people took the time to scrutinize the board as they should have...myself included.)

"Colonel Winthrop" was arrested, tried and convicted of grand theft under false pretenses. Unfortunately, a large sum of the monies he had received from the computer hobbyist community was not recovered. So, "Winthrop" was sent off to prison (for a measly 3 years) and left many of his victims holding the bag, including his wife and three young children.

Escape #1

He escaped from the California State Prison at Chino on February 26th, 1978, after "conning" his way into the minimum security area of the prison. Furthermore, he apparently had several staff members convinced that he was on the verge of a major breakthrough in the field of solar energy, which is another industry that should be keeping a watchful eye on him and his games.

World Power Systems, Inc.

He landed in Tucson, Arizona, and decided that, since we computer hobbyists had been so dumb and gullible last time, he ought to "stick it to us" again! He adopted the alias of "Jim Anderson," picked up a new wife, whose name was "Lee Anderson," formed an association with a man named Perry Pollock and put together a company called World

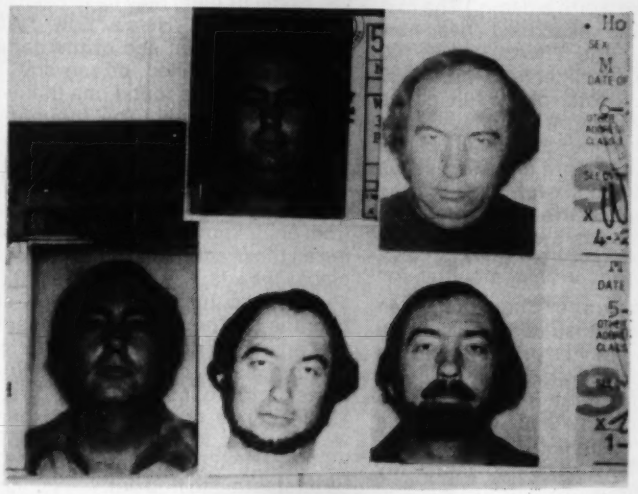


Photo 1. Pictures of Winthrop/Anderson.

Photo 2. Office Building where World Power Systems was located, 1161 N. El Dorado Place.

Photo 3. Inside of Office.

Photo 4. Office Entrance.

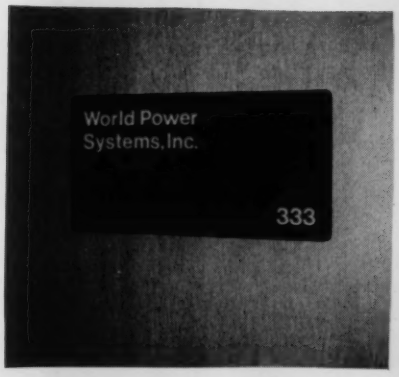


Photo 5. World Power Systems, Inc. Office Door.

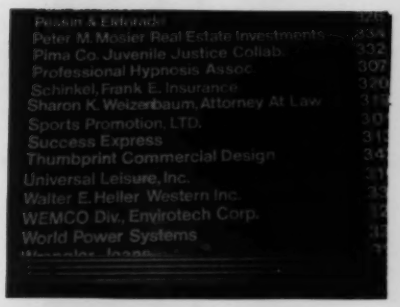


Photo 6. Building Directory, listing World Power Systems.

Burned, con't....

Power Systems, Inc. Their ads, shown in Photo 8, struck me as being a little ridiculous, with regard to approach, but I wasn't suspicious of any wrongdoing. I just figured it was some "garage-type" operation that would eventually fade from the scene. Why didn't we take a closer look?! It wasn't a little ridiculous, it was very ridiculous!

This time "Winthrop" was shooting for bigger stakes. What the heck, if your objective is to rip off as many people as possible, you sure can't do it with a few half page ads here and there. He put together an ad campaign which was definitely in line with his brazen style. **Interface Age** was once again blessed with being the first to receive his ads. Eight full pages appeared in the March and April issues which featured the "hokey" introduction from Perry Pollock and his wife Korrine. (Upon reading that copy in retrospect, I can see that it was surely written by "Winthrop." It sounds like him. It has the same poor sentence structure and spelling which was evident in an article he tried to write for me once. (He may be able to talk a good line but he can't write worth a damn.) The rest of those ads described five new products for the TRS-80, an S-100 EPROM Programmer and an S-100 I/O board. A total of 10 full pages were run in the April and May issues of **Byte** magazine. Seven full pages appeared in the April and May issues of **Kilobaud** and six full pages in the May issue of **Creative**. The grand total is 31 full-page ads...which would cost well over $30,000 - if they had been paid for.

What were your thoughts when you first saw those ads? I'll tell you what mine were. Perry Pollock and his wife are obviously a young couple; therefore, my first impression was that he probably hadn't made his fortune yet, but perhaps had some wealthy relatives behind him. My main thought was about the ads and the bundle of money they must have paid for them. I never gave much thought to the fact the ads went out of the way to depict a garage-type operation and what would actually be required to manufacture and ship all those products to thousands of TRS-80 and S-100 system owners. You don't do that sort of thing in a garage!

The fact is, those ads weren't paid for. Some of them may have been but not very many. Here's how "Winthrop" played that end of the game: He probably called on several ad agencies until he found one that was hungry and greedy. The thought of commissions on $30,000 worth of ads made the right agency (I don't know, or care, who it was) use some very poor judgement in taking an order from an unknown company and placing all those ads. You see, the agency places the ads, the magazines bill the agency who then turns around and bills the customer. (In all fairness to that agency, I did hear that **Interface Age** did some checking into World Power and found that they had a $900,000 line of credit from Honeywell. I don't know how "Winthrop" pulled off that phony line, but it would be interesting to find out.)

"David Winthrop/Jim Anderson" bailed out of World Power Systems on April 25th, 1979. He left the ad agency holding the bag, several distributors with thousands invested in non-existant products, creditors who had shipped $100,000 to $250,000 worth of equipment, thousands of customers who had sent their money in good faith, and Perry Pollock, age 22, to be arrested by the Pima County

NEW FROM....
DataSync Corp.
DS-STAND ALONE KEYBOARD
DS-16K RAM MEMORY BOA
DS-MONITOR BOARD
DS-100 VIDEO TERMINAL
DS-STAND ALONE INTERFACE CARD
DS - S/P/S ADAPTER
Fully S-100 bus compatible.
2 parallel I/O ports and keyboard port.
On board 2K monitor in 2708 Rom.
Runs with 8080-based software.
2 Add-ten 2708 sockets. Selectable to any 1K boundary.
2K of ram are provided. Resides at F800H.
DataSync system monitor includes over 25 separate monitor commands including name files, search, memory diagnostic.
A video driver routine that may be used with any video board.
All data input to the monitor may be in OCTAL, HEX, or ASCII format.
$298 KIT / $375 ASSEMBLED
OPTION A
8085 CHIP turns the DS-Monitor into an entire one board system. Power on jump.
$398 KIT / $475 ASSEMBLED
Internal microprocessor control.
True word processing with character and line insert/delete.
24 lines by 80 characters.
Special individual function keys control the block screen, screen protect, forms mode, tabs, scroll up scroll down, print page, line center ing and many other modes.
All switches CHERRY gold cross point
A full-functional light pen included.
Two RS-232 ports, 1-printer, 1-CPU.
DATA SYNC cassette interface port, or Tarbell format reads and writes to or from the screen or computer, up to 4800 baud
ALL FUNCTIONS switchable from the front panel.
Terminal weighs under 30 lbs. and is housed in strong ABS cabinet.
EIGHT cell graphics (96x100)
And many extra features
$695 KIT / $795 ASSEMBLED
NAME
ADDRESS
CITY STATE ZIP
ITEMS DESIRED
$
$
ENCLOSED FIND CHECK OR MONEY ORDER
TOTAL $
M/C # BA # EXP. DATE
DATASYNC CORP. / 201 W. MILL / SANTA MARIA, CA 93454 / 805-922-4764

Photo 7. DataSync Advertisement.

Attorney's Office. Unfortunately, yours truly was responsible for him taking off. I had been looking into the activities of World Power Systems since the 10th of April and on the 23rd I placed a call to them. The purpose of the call was a "bluff" in which I told Lee Anderson that I was coming to Tucson on the 1st of May and wanted to stop by and do a story on their operation. (I didn't suspect that "Winthrop" was involved in the company, just that something was wrong.) I had no intention of going - I just wanted to see what their reaction would be. She called back several hours later and told me they had some things going that day but if I could make it the 3rd or 4th, that would be fine. I said I would see if my schedule could be rearranged and get back to them which I never did. They packed up and left two days later. On the one hand I'm bitterly disappointed that my phone call scared them away, because it means they made off with most of the money, plus, they weren't arrested. On the other hand, I'm thankful that the operation was terminated early — and it was early. He was still counting on raking in the results of the May ads in **Creative**, **Byte** and **Kilobaud**.

Escape #2

On Wednesday, April 25th, "Jim Anderson" loaded up a van with equipment and left Tucson. He took two of his secretaries with him, having told them they were going to Florida to set up a plant and also put the girls in school to learn computers. The girls left almost at a moments notice without even notifying close relatives...another example of his persuasive talents. "Lee Anderson" remained behind (supposedly ill, so she didn't come into the office). However, she did make it to the Post Office for the next few days to pick up the mail and checks. Perry Pollock drove her to Albuquerque to meet the others on Friday, the 27th. After traveling for several days one of the girls became suspicious because it appeared they were just aimlessly moving around Texas rather than heading for Florida. She called her father back in Tucson and he flew to Texas and picked her up. The father had become quite worried when his daughter disappeared and began an investigation of his own into World Power; plus, he got the Pima County Attorney's Office going on it at the same time. "The Andersons" and the other secretary dumped the contents of the van into a storage locker (which has undoubtedly been recovered by the police by now) and started moving north. They stopped and bought a new Ford Fairmont, for cash, and then, for some reason, abandonded it in Oklahoma and bought a new van, once again, with cash. About this time the other secretary decided to get out and she returned to Tucson. She told the authorities she was under the impression that "Jim Anderson" only had about $8,000 left.

Shortly after their departure the two offices of World Power Systems were put under surveillance along

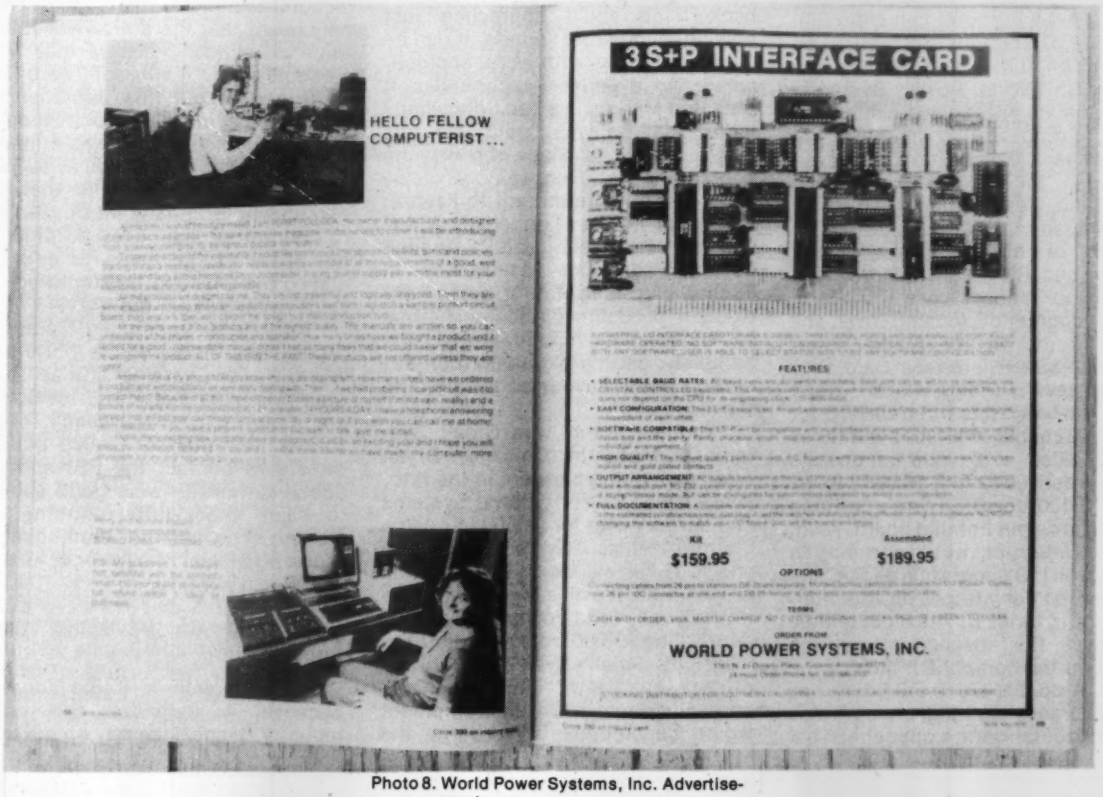


Photo 8. World Power Systems, Inc. Advertisement.

Burned, con't....

with the homes of the "Andersons" and Pollock. On the morning of Monday, April 30th, Perry Pollock was observed loading a van with equipment from "Anderson's" house. He took the equipment to his home where he was arrested by investigators Susan Moore and Paul Banales of the Pima County Attorney's Office. A search warrant was obtained for all of the homes and offices involved (plus some storage lockers) in which large quantities of equipment were discovered. They also found the complete mockups for all those TRS-80 products being advertised — nicely painted boxes with dummy switches, indicators and sockets mounted in them.

One of the investigators told me this kind of operation is called a "bust out" and one of the main objectives is for the company to get to the point of having established credibility. Then large orders are placed for equipment from suppliers and financial backing for expansion is secured from a bank or lending institution. Once the equipment is in hand and the bank loan secured the con man "busts out," taking everything with him.

What Started All This?

I received a phone call from Bill Godbout, of Godbout Electronics, on the 10th of April which fired up my interest in World Power Systems. Bill's primary reason for calling me was a strong feeling he has, and which I share, that we have to keep an eye open for the bad guys...and something was looking "bad" with this company.

Two of his designers, Kevin Fischer and Rick Kalish, have been developing Godbout's new I/O board. In the course of looking over the photo in the ad for World Power Systems' 3S + P Interface Card they noticed several things which weren't right. The board has three UARTS for the RS-232 serial interfaces and these UARTS need +12 volts to operate which is derived from +16 volts (pin 2 on an S-100 board). There's nothing coming in on pin 2 of that board. Also, vectored interrupts would normally be used for an I/O board such as that and there weren't any traces on the interrupt pins (4 thru 11). The most telltale item was the absence of enough traces on the component side of the board. A double-sided PC board has vertical traces running on one side and horizontal on the opposite. That 3S + P board was very dense with ICs and there's no way all of it could have worked with just the few vertical traces shown on the component side.

Bill wanted me to get someone to order one of those boards so we could find out if it was legitimate. I asked an old friend, Hal Singer, if he would place an order for one so we could see what happened. He called (on April 20th) and asked what he could expect in the way of delivery time for one of the 3S + P boards. He was told 3 to 4 weeks, which means his MasterCharge would have been billed by then and he would have to go through the hassle of cancelling the bill if the board didn't come through. After discussing the board with Ron Markus, the General Manager, he was further convinced that delivery was unlikely, so he declined placing an order. Hal mentioned to Ron that there were some questionable things about the board and he was wondering if that was perhaps a prototype board they had used for the photo. Ron replied that the new board didn't look anything like the one in the photo, it only had ONE UART...which was "time-shared" with the 3 serial ports through high-speed switching...each with independent baud rates! (if you've got a reasonable hardware background you'll appreciate just how ridiculous that sounds. It can be done, but only with very sophisticated and expensive techniques. It puts Ron Markus in a bad light when I report that he was "sold" on this whole thing and that's the way he sounded to Hal. Ron was one of the victims and it's important to keep in mind that he was conned by a real expert. He feels badly enough because some of his friends in Tucson paid for some of those non-existent products. "Anderson" tried to make him president of the company, shortly before he took off, so Ron would have been left holding the bag.)

Another victim was Small Systems Services in Chicago, Bryan Allen, one of the partners in the firm, sent a check to World Power Systems on February 24th for $4,500 to open a distributorship. (Pay close attention and you'll get a good feel for how this scam works. It's all a matter of delaying tactics.) World Power was initially demanding $9,000 from new distributors but Small Systems Services offered half and "Jim Anderson" agreed. He told them their shipment would be shipped by Airborne the following day. The shipment didn't arrive. Bryan called "Anderson" and was told that Airborne had been unable to find their address. Bryan then called Airborne and discovered they had no record of the shipment. More phone calls, more excuses, and then a promise that the shipment would be going out via UPS Blue Label. Once again, it didn't arrive. Finally, on March 16th Bryan demanded that their $4,500 be returned. The same delaying tactics began all over but this time there were a lot of unanswered telephone messages and no Jim Anderson when Bryan was calling. They never did get their money back.

Bryan Allen has a very nice telephone conversation recording system and he used it during the many phone conversations he had with "Jim Anderson." (By the way, did you know that it is perfectly legal to record a phone conversation as long as at least one party consents, e.g., the person doing the recording? It's illegal to tap into a conversation and record two people without their consent.) He played a couple of those tapes for me over the phone and my 'ol buddy "Winthrop" didn't have more than 5 words out of his mouth before I recognized him. Up to that point I had only heard that the police had found evidence which indicated that "Anderson" and "Winthrop" were the same person but this was the real clincher for me. (I'll be making a sworn statement that it was him and only hope it helps put him away.) An interesting coincidence is that the person who originally introduced me to "Winthrop" happened to drop by my office at the same time Bryan played the tape and he identified the voice as quickly as I did.

Terry Reiter's company, California Digital, was listed at the bottom of World Power Systems' ads as being their "stocking distributor for Southern California." He wasn't. They almost took him for $3,000 but his threats to contact the FBI and the postal authorities were good enough to scare them into returning his money. (Too bad he didn't contact those agencies, they'd both like to see "David Winthrop.")

Now, What Are We Going To Do About It?

This is really a tragic situation because it damages the entire industry. Magazines rely on advertis-

ing for revenue and manufacturers rely on that advertising for revenue. If sales drop drastically (or never get off the ground), because the reader/customer is afraid of losing money to this kind of fraud, then eventually those manufacturers won't be buying advertising and they'll probably fold. I think the biggest concern will be with newcomers into the field. The older, established firms probably won't be affected at all.

I suspect the immediate reaction of most people is to blame the magazines for accepting the ads in the first place. What should we do, demand to see each and every product for which we run ads? Well, in some cases that might not be a bad idea but I doubt if it would work. Some companies place ads for products which are near completion, taking into account the two-month lead time for magazines. In such a case, the magazine might request a prototype board. Fine, but what if the company wanted to put together an ad campaign which included the five or six most popular magazines. There's usually only one or two prototype boards produced and it's doubtful that a company would want to even let one of them go during that stage of development. Then there's the problem, from the magazine's standpoint, of paying someone to check out all those products (either someone on the staff or outside). But, to top it all off, how do you handle an entire system (built into a desk, for example)? Does the company ship the whole thing to each magazine in which they want to advertise? Who gets stuck with the shipping?

The best, and safest approach, for any mail-order buying is to use a credit card such as Visa or MasterCharge. Under the provisions of the Consumer Protection Act you can go to the bank which issued your card and pay the bill, except for the disputed amount. You then fill out a "disputed or fraudulent billing" claim. The bank then reverses the charge on your bill and goes back to the merchant for the amount due. It's very important that the customer get in touch with the merchant first. Otherwise, the bank won't even be interested in talking with you. In the case of World Power Systems charges, people who used their cards probably still have recourse. I'd certainly check into it, anyway.

COD's have some good points and some bad. However, any company which flat refuses to ship COD (such as World Power) should be suspect. A couple of the disadvantages for the consumer are: 1.) The cost is higher. The customer has to pay additional charges; 2.) The customer has to go to the trouble of getting a certified check, money order, or cash if the company won't accept personal checks. Disadvantages to the company are: 1.) Customers sometimes change their mind and the company is then stuck with the shipping both ways; 2.) Bad personal checks can be a real hassle to collect. Therefore, many companies won't accept them. My own personal feeling on the matter is that COD is the preferred way to go especially with a new company. If I want a product bad enough I'm not going to object to paying a little extra in COD charges or going to the trouble of getting a money order. The most important thing is that the product be in my hand when I shell out my money.

Several companies in the industry have put their heads together as a result of this thing and are going to try and come up with a solution that will benefit the consumer. Godbout Electronics, HUH Electronics, JADE, Priority 1, California Digital and George Morrow's Thinker Toys are tossing around the idea of forming a "mail-order association" which will have a bond or insurance to back up products they sell. If the customer is unhappy then he can go to the association for a refund. The idea is that new companies will join this association, after being checked out for validity, and they'll be able to put in their ads that they're members.

Closing Thoughts...

The saddest part of all this is that it's just one man who has come along and messed things up for the rest of us. There haven't been any other con artists trying to rip off the computer hobbyist industry, just "Colonel Winthrop." Because of him we're all going to have to be a little paranoid and make sure he, or someone like him, doesn't come along and get to us again.

There are some people who will express some admiration for what he's done, but I won't be one of them. Along with the thousands of people who sent money in good faith (which will now be destroyed), he's probably managed to put some of the smaller stores and distributors out of business. Many of those smaller businesses can't handle the strain of losing 2 or 3 thousand dollars to something like this. His lower-cost S-100 interface, for example, was hurting the sales of companies (such as HUH Electronics) who have one for real.

I sincerely hope he's in jail, where he belongs, by the time this issue reaches you. Just in case he isn't, I've included some photographs of him (courtesy of the Santa Maria, California Police Dept.). He's a white male, 6' 3" (i.e., TALL), 220 pounds, with reddish brown hair and hazel eyes. Some of his past alias and areas of operating are: William D. Winthrop, California; William Frank Northrup, Texas; Harold Bender, Nevada; William A. Scoville, Nevada/Arizona (Scoville Automation - later changed to National Digital Computer Corporation); Robert L. Renfro, Georgia (Digi-Tone Communications Corp.) His new wife, "Lee Anderson," (whose real name is believed to be Robinson) is white, approximately 5'6", 35 to 40 years, has short strawberry blonde hair and wears large, frameless glasses.

Apparently the first lesson he gave us wasn't enough. We certainly forgot it soon enough. I think I'll write an editorial on this in about a year as a reminder. □

Another new game from Creative Computing . . . .

BRAIN TEASER

Hal Knippenberg

At first glance, "BRAIN TEASER" appears deceptively simple but, unless you are very lucky or very smart, you will use far more than the six maximum moves needed to solve this puzzle.

The program begins by setting up a 3 x 3 playing board. The board is randomly filled with 0's and one or more 1's.

The object of the puzzle is to change the patterns of 0's and 1's until the board has a 0 in the center and 1's in all other positions.

To make a board change, select a square that contains a 1. You tell the computer which square you are pointing to by entering the square's address number.

A possible starting board and its addresses are as follows:

```
0 1 0     1 2 3
0 1 0     4 5 6
0 0 1     7 8 9
```

There are three ways the board will change as you select different addresses. If you print to the center square (Address 5), all but the corner squares will change state (1's will change to 0's and 0's will change to 1's). For example:

```
0 1 0                 0 0 0
0 1 0 will change to  1 0 1
0 0 1                 0 1 1
```

If you select a corner square (Addresses 1, 3, 7 or 9), that corner and the three adjacent squares will change state. For example, if you point to Square 9:

```
0 1 0                 0 1 0
0 1 0 will change to  0 0 1
0 0 1                 0 1 0
```

Finally, if you choose a square at the center of an edge (Addresses 2, 4, 6 or 8), the three squares along that edge will change state. For example, choose Square 2:

```
0 1 0                 1 0 1
0 1 0 will change to  0 1 0
0 0 1                 0 0 1
```

One last fact, if you happen to end up with all 0's, you lose! (I've been

Hal Knippenberg, 2514 Blueberry Drive, Augusta, Georgia 30906.

```
100 REM  BRAINT    10 APRIL 79    HAL KNIPPENBERG
105 REM
110 REM  PATTERNED AFTER A MACHINE LANGUAGE PROGRAM USED TO
115 REM  DEMONSTRATE DIGITAL GROUP EQUIPMENT
120 REM
125 REM  VARIABLES:  A$.....ANSWERS TO COMPUTER QUESTIONS
130 REM              B().....ARRAY TO HOLD BOARD
135 REM              E......ERROR FLAG
140 REM              I......INDEX COUNTER
145 REM              M......MOVE COUNTER
150 REM              S......SUMMING REGISTER
155 REM              S$.....STORAGE STRING
160 REM              T......TEMPORARY STORAGE REGISTER
165 REM              W$.....WIN/LOSE FLAG
170 REM              X......POINTS TO PLAYERS MOVE
175 REM              Z......CALLS MACHINE LANGUAGE SUBROUTINES
180 REM
185                  DIM B(9)
190                  DIM S$(45)
195 REM
200 REM * * * * * * * * * * * * * * * * * * * * * * * * * * * *
205 REM              START OF MAIN ROUTINE
210 REM
215      LET M = 0                        :REM  INITIAL MOVE COUNT
220      GOSUB 625                        :REM  SET UP BOARD
225 REM
230      Z = CALL(12762)                  :REM  CLEAR SCREEN
235 REM
240      PRINT""
245      PRINT"    B R A I N   T E A S E R"
250      PRINT""
255 REM
260      GOSUB 700                        :REM  PRINT BOARD
265 REM
270      INPUT"DO YOU WANT INSTRUCTIONS ?  ",A$
275      IF A$(1,1) <> "Y" THEN 450
280 REM
285      Z = CALL(12762)                  :REM  CLEAR SCREEN
290 REM
295      PRINT"     THE OBJECT OF THIS PUZZLE IS TO CHANGE THE"
300      PRINT"PATTERNS OF 0'S AND 1'S UNTIL THE BOARD HAS A 0"
305      PRINT"IN THE CENTER AND 1'S IN ALL OTHER POSITIONS."
310      PRINT"     TO CHANGE THE BOARD PATTERN, ENTER THE "
315      PRINT"NUMBER OF A SQUARE THAT CONTAINS A 1.  ENTER THE"
320      PRINT"SQUARES POSITION NUMBER AS FOLLOWS:"
325      PRINT""
330      PRINT"              1  2  3"
335      PRINT"              4  5  6"
340      PRINT"              7  8  9"
345      PRINT""
350      PRINT"     CHOOSING A SQUARE IN THE CENTER OF AN EDGE"
355      PRINT"(2,4,6,8) CAUSES ALL POSITIONS ALONG THE EDGE TO"
360      PRINT"CHANGE STATE.(0'S BECOME 1'S AND 1'S BECOME 0'S)"
365      PRINT""
370      INPUT"PRESS RETURN TO CONTINUE ",A$
375 REM
380      Z = CALL(12762)                  :REM  CLEAR SCREEN
385 REM
390      PRINT""
395      PRINT"     CHOOSING A CORNER SQUARE (1,3,7,9) CAUSES"
400      PRINT"THE CORNER SQUARE AND THE THREE ADJACENT SQUARES"
405      PRINT"TO CHANGE STATE."
410      PRINT""
415      PRINT"     FINALLY IF YOU CHOOSE THE CENTER SQUARE (5),"
420      PRINT"ALL BUT THE CORNER SQUARES WILL CHANGE STATE."
425      PRINT""
430      PRINT"     TO END THE GAME, ENTER A MOVE OF 0."
435      PRINT""
440      INPUT"(PRESS RETURN TO BEGIN THE GAME) ",A$
445 REM
450      GOSUB 690                        :REM  PRINT BOARD
455 REM
460      GOSUB 780                        :REM  WIN CHECK
465      IF W$ <> "" THEN 535
470 REM
475      INPUT"YOUR MOVE ? ",X
480      IF X = 0 THEN 535
485 REM
```

```
490     GOSUB 845                       :REM  MOVE CHECK
495     IF E = 1 THEN 475
500 REM
505     GOSUB 910                       :REM  REVISE BOARD
510 REM
515     LET M = M + 1
520 REM
525     GOTO 450
530 REM
535     PRINT""
540     IF W$ = "WON" THEN PRINT"   Y O U   W O N  !"
545      IF W$ = "LOST" THEN PRINT"   Y O U   L O S T !"
550     PRINT""
555     PRINT"IT TOOK YOU ";M;" MOVES."
560     PRINT""
565 REM
570     INPUT"WOULD YOU LIKE TO TRY AGAIN ? ";A$
575     IF A$(1,1) = "Y" THEN 215
580 REM
585     PRINT""                         :REM  END IF PLAYER QUITS
590     PRINT""
595     END
600 REM
605 REM         END OF MAIN ROUTINE
610 REM * * * * * * * * * * * * * * * * * * * * * * * * * * *
615 REM  SUBROUTINE:     SET UP BOARD
620 REM
625     LET S = 0
630     FOR I = 1 TO 9
635        LET T = RND(0)
640        IF T <= .9 THEN B(I) = 0
645         IF T > .9 THEN B(I) = 1
650        LET S = S + B(I)
655     NEXT I
660     IF S = 0 THEN 630
665     RETURN
670 REM
675 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
680 REM  SUBROUTINE:     PRINT BOARD
685 REM
690     Z = CALL(12762)                 :REM  CLEAR SCREEN
695 REM
700     PRINT"THE BOARD AFTER MOVE ";M
705     PRINT""
710     PRINT""
715     FOR I = 0 TO 6 STEP 3
720        FOR J = 1 TO 3
725           LET T = I + J
730           PRINT"  ";B(T);
735        NEXT J
740        PRINT""
745     NEXT I
750     PRINT""
755     RETURN
760 REM
765 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
770 REM  SUBROUTINE:      WIN CHECK
775 REM
780     LET S = 0
785     LET W$ = ""
790     FOR I = 1 TO 9
795        LET S = S + B(I)
800     NEXT I
805     IF S = 0 THEN W$ = "LOST"
810     IF S <> 8 THEN 820
815      IF B(5) = 0 THEN W$ ="WON"
820     RETURN
825 REM
830 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
835 REM  SUBROUTINE:      MOVE CHECK
840 REM
845     LET E = 0
850     IF X > 9 THEN 870
855      IF B(X) = 0 THEN 870
860     RETURN
865 REM
870     PRINT"  ILLEGAL MOVE, RE-ENTER."
875     PRINT""
880     LET E = 1
885     RETURN
890 REM
895 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
900 REM    SUBROUTINE:    REVISE BOARD
905 REM
910     S$ ="124501230023560147002456836300457807390056890"
915     LET B(0) = 5
920     FOR I = (5*X - 4) TO 5*X
925        LET T = VAL(S$(I,I))
930        IF B(T) = 0 THEN B(T) = 1 ELSE B(T) = 0
935     NEXT I
940     RETURN
945 REM
950 REM - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

able to lose several times in fewer than six moves.)

A "WIN" looks like this:

```
1 1 1
1 0 1
1 1 1
```

Try it — You'll hate it!

The program was written in MAXI-BASIC and should work with few modifications in most other BASIC's. However, there are several lines of code that might best be explained.

Z = CALL(12762) is a call to a machine language subroutine that instantly clears the TV monitor. (MAXI-BASIC has no specific command that will clear the screen.) If you have no CLEAR SCREEN command, try a BASIC subroutine to do the job, i.e.:

```
FOR I = 1 to 16
   PRINT""
NEXT I
RETURN
```

The BASIC subroutine will be slower than its machine language counterpart, but it will get the job done.

Try programming a simple graphics version of BRAIN TEASER with light squares representing the 1's and dark squares the 0's. Try to incorporate sound effects too. □

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Another new game from Creative Computing . . . .

ZoneX

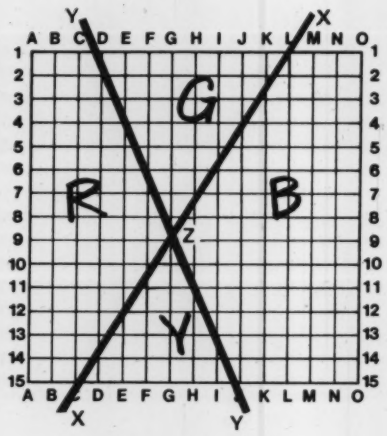
Jim Madeheim

In the best tradition of other Invicta classics, ZoneX is a combination of guessing and strategy. The object of the game is for one player (the Zone Breaker) to find the target point set by the other player (the Zone Maker) in a minimum number of moves. The game is played on a coordinate grid.

At the start of the game, the Zone Maker secretly selects a target point on his "marker grid." He then draws two straight lines which are continued out to the edge of the grid. The Zone Maker now writes R.B.G.Y. in the four quadrants on his grid to represent the four colors (red, blue, green, yellow) created by the intersecting lines. The red and blue quadrants must always be opposite each other.

The Zone Breaker then tries to find the target point, using his own searchboard. The Zone Maker's marker grid is hidden from him. The Zone Breaker finds a point and then the Zone Maker tells the Zone Breaker what color peg to place there. For instance, if the Zone Breaker had picked a point in the red area, then the Zone Maker would tell him to place a red peg there. This continues until the Zone Breaker can figure out where the target point is. If the Zone Breaker picks a point on one of the boundary lines, then the Zone Maker must tell him and a black peg is placed.

Some variations of the game allow for curved lines to be used. But when this is done, the game deteriorates from a thinking game into a guessing game. The more the lines are curved, the more fun the game is for the Zone Maker and the less interesting it is for the Zone Breaker. Since the computer plays as the Zone Maker, I'll let him have the dull time so I can have a good time. Thus, this program works with straight lines only.



If you want to type in this program with multiple statements on each line, the only lines that are referenced are the lines that end in zero. If you are using a slow printing terminal and have "TRM$" available, then change the period in line 1100 to a space and; change line 1121 to -PRINT TRMS$ (B$)-.

The game comes with a 15 by 15 grid. If your terminal will print out more than 15 lines then change line 2 to -P = 15-.

On my computer the ASCII value for A is 1. If yours is 65, then change line 1077 to...CHR$(I + 64).

SEG$(W$,4,8) means examine W$ starting with the 4th character and ending with the 8th character, inclusive.

POS(Y$,",",7) means search Y$ for a "comma" starting with the character in the 7th position.

If you cannot use this statement then delete lines 1030, 1032, 1036, 1040, 1047, 1073. These lines allow you to make more than one guess at a time. I use multiple guesses on the first guess only.

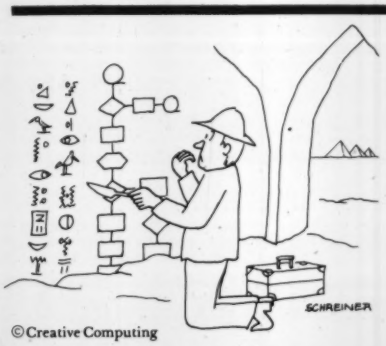
DIM N$(225,3) means that there are 225 subscripted N$'s and they are each 3 characters long.

The method for plotting the colors:

I picked the point of intersection and then a second point which defines one of the lines. I then picked a third point which defines (with the point of intersection) the second line. Then I found the equation for each line using the slope-intercept method. The colors of the four areas were determined by the graphing of inequalities, using the two lines as boundaries.

Since almost one-third of the points are on the edges of the grid, I weighted the random selection of the point of intersection so there would be more four color grids and less three color grids. □

Jim Madeheim, 3802 W. Medina Rd., Tucson, AR 85706.



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```
1       RANDOMIZE
2       P=11
3       W=P*P
4       DEF FNZ(P)=INT((P-1)*RND(X)+1.5)
5       DIM N$(225,3),B$(30),Y$(30),X$(30),Q$(14)
6       Q$="  NEXT GUESS"
7       FOR I=1 TO 6
9       READ C$(I)
11      NEXT I
12      DATA "*","W","R","G","B","Y"
14      PRINT "DO YOU WANT INSTRUCTIONS (1=YES, 0=NO)"
16      INPUT A$
18      IF A$<>"1" THEN 20
19      GO SUB 3000
20      FOR I=1TO W
22      N$(I)=" "
23      NEXT I
27      G=0
40      X1=FNZ(P)
42      Y1=FNZ(P)
44      X2=FNZ(P)
46      IF X2=X1 THEN 40
48      Y2=FNZ(P)
52      M1=(Y2-Y1)/(X2-X1)
54      B1=Y1-M1*X1
80      X2=FNZ(P)
84      IF X2=X1 THEN 80
88      Y2 =FNZ (P)
93      M2=(Y2-Y1)/(X2-X1)
97      B2=Y1-M2*X1
99      FOR X=1 TO P
101     Z1=M1*X+B1
107     Z2=M2*X+B2
111     FOR Y=1 TO P
123     K=0
136     IF ABS(Z1-Y)>.001 THEN 250
138     Z1=Y
250     IF ABS(Z2-Y)>.001 THEN 270
252     Z2=Y
270     IF Y<>Z1 THEN 300
283     K=1
300     IF Y<>Z2 THEN 400
307     K=K+1
323     GO TO 1000
400     IF K<>0 THEN 1000
421     K=3
431     IF Y>=Z1 THEN 500
351     K=K+1
500     IF Y>=Z2 THEN 600
543     K=K+1
600     IF K=3 THEN 1000
607     IF K=5 THEN 1000
714     K=6
819     IF Y>Z1 THEN 1000
957     K=4
1000    N$((P-Y)*P+X)=C$(K)
1003    NEXT Y
1007    NEXT X
1008    PRINT
1009    PRINT "YOUR FIRST GUESS";
1010    INPUT X$
1013    IF X$="99" THEN 2000
1017    S=1\Y$=X$
1030    R=POS (Y$,",",S)
1032    IF R<>0 THEN 1040
1034    X$=SEG$(Y$,S,LEN(Y$))
1036    GO TO 1050
1040    X$=SEG$(Y$,S,R-1)
1047    S=R+1
1050    IF LEN (X$)>3 THEN 1010
1052    X=ASC(SEG$(X$,1,1))-0
1053    IF X<1 THEN 1010
1054    IF X>P THEN 1010
1055    Y=P+1-VAL(SEG$(X$,2,LEN(X$)))
1057    IF Y<1 THEN 1010
1059    IF Y>P THEN 1010
1061    Q=(P-Y)*P+X
1062    IF LEN(N$(Q))<=1 THEN 1070
1063    PRINT " DUMMY"
1064    GO TO 1010
1070    N$(Q)=N$(Q)&" "
1071    G=G+1
1072    IF N$(Q) ="W"THEN 1990
1073    IF R<>0 THEN 1030
1075    PRINT"   ";
1076    FOR I=1 TO P
1077    PRINT CHR$(I);" ";
1079    NEXT I
1081    FOR L=1 TO W STEP P
1082    I=L+P-1
1083    PRINT
1084    PRINT STR$(I/P);TAB(4);
1085    B$=""
1086    FOR J=L TO I
1089    IF LEN(N$(J))=1 THEN 1100
1093    B$=B$&N$(J)
1097    GO TO 1120
1100    B$=B$&", "
1120    NEXT J
1121    PRINT B$;
1122    NEXT L
1123    PRINT TAB(26);Q$;
1126    GO TO 1010
1990    PRINT "YOU WIN!!!!!!!!!  ";G;"GUESSES"
2000    FOR L=1 TO W STEP P
2004    FOR J=L TO L+P-1
2007    PRINT SEG$(N$(J),1,1)&" ";
2019    NEXT J
2023    PRINT
2027    NEXT L
2029    GO TO 20
3000    PRINT "TWO LINES INTERSECT BREAKING THE GRID INTO 4 SEPARATE"
3002    PRINT "AREAS.  BLUE AND RED ARE ALWAYS OPPOSITE EACH OTHER AS ARE"
3004    PRINT "GREEN AND YELLOW.  YOUR JOB IS TO FIND THE TARGET"
3006    PRINT "POINT WHERE THE LINES CROSS, MARKED -W-.  PICK ANY"
3008    PRINT "POINT ON THE GRID (E.G.  B6), AND I WILL TELL YOU WHAT"
3012    PRINT "COLOR IT IS.  IF YOU PICK A POINT ON A LINE, I WILL PRINT"
3014    PRINT "OUT AN -*-.  THE GAME IS OVER WHEN YOU FIND THE -W-."
3016    PRINT "ANYTIME YOU TYPE IN -99- I WILL SHOW YOU THE COMPLETE GRID."
3018    PRINT "YOU CAN GUESS MORE THAN 1 POINT AT A TIME BY SEPARATING YOUR"
3022    PRINT "GUESSES WITH COMMAS"
3024    RETURN
3026    END
```

```
RUNNH

YOUR FIRST GUESS
? C3,C8,H3,H8
   A B C D E F G H I J K
1
2
3       R           R
4
5
6
7
8       G           Y
9
10
11                                  NEXT GUESS? E7
   A B C D E F G H I J K
1
2
3       R           R
4
5
6
7           G
8       G           Y
9
10
11                                  NEXT GUESS? G7
   A B C D E F G H I J K
1
2
3       R           R
4
5
6
7             G   R
8       G           Y
9
10
11                                  NEXT GUESS? G8
YOU WIN!!!!!!!!!!!!   7 GUESSES
R R R R R R R R R R R
* R R R R R R R R R R
G * R R R R R R R R R
G G * R R R R R R R R
G G G * R R R R R R R
G G G G * R R R R R *
G G G G G * R R * Y Y
G G G G G G * Y Y Y Y
G G G G * B B * Y Y Y
G G * B B B B B * Y Y
* B B B B B B B B * Y
```

puzzles & problems

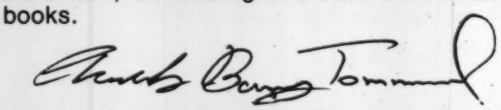
It's mail time on Merlin's Isle and the first order of business deals with the puzzle called "A Weightly Matter" which appeared in the April issue. In it we asked the question "With how many weights and of what denominations respectively, can you weigh any number of pounds from 1 to 127 inclusive?" Our answer was seven weights, of 1, 2, 4, 8, 16, 32 and 64 lbs. respectively. It has been brought to our attention, by several of our readers, that you can make these measurements, using just six weights, if you place them in both sides of the scales along with the weight to be measured. (These weights are 1, 3, 9, 27, 81 and 243 lbs. respectively). Merlin claims that he meant that the weights used in his solution were to be placed on one side only of the balance scales and that it was our fault for not realizing this, to him, obvious fact. Merlin hates to admit he's wrong, but, it doesn't do any harm to take him down a peg once in awhile. My thanks go out to Carey Tyler Schug, Maurice D. Anderson, Andrew Behrens, and Jay Parsons for submitting this alternate solution.

Another problem, in the same issue, that no one picked us up on was called "Alice In Puzzleland" and it asked the reader to place the remaining letters of the alphabet correctly above and below the line shown in the picture. Unfortunately, the solution was omitted from the answer section. It was really quite simple (I can hear Merlin chuckling from here). All of the letters above the line are made with straight lines only, while, all of the letters below the line are made with straight and curved lines.

A EF HI KLMN
BCD G J OP

The following puzzles are from our readers who will each receive a copy of "Merlin's Puzzler #2" for their efforts. Anyone with a favorite puzzle, be it old or new, is encouraged to send it in. If Merlin uses your material he will send you a copy of one of his books.

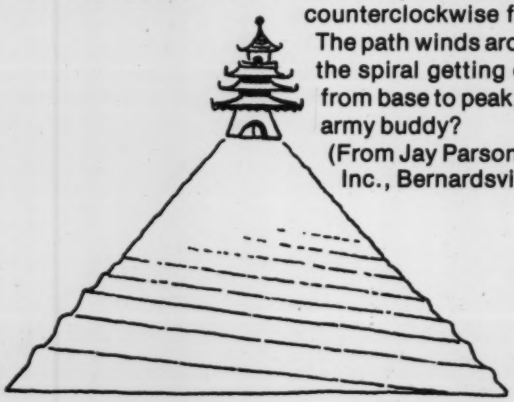
Your Editor



THE PUZZLE OF MOUNT FOOLISAMA

The samurai swordsman pictured here might well be singing that old song "There's a long, long trail a winding..." as he contemplates the castle of his enemy perched on top of Mount Foolisama. Now, Mount Foolisama is in the shape of a perfect right circular cone. It measures two kilometres across at the circular base and it stands exactly one kilometre high above the plain below. A long path ascends counterclockwise from the base of the mountain to the castle at the top. The path winds around and around, with a slope of one metre in ten, with the spiral getting even tighter. How far will the samurai have to travel, from base to peak, before he can have a martial arts workout with his old army buddy?

(From Jay Parsons, Somerset Data Systems, Inc., Bernardsville, N.J.)



Answers on page 160

TEA TIME TOMFOOLERY

"You're late again, Alice," cried the Mad Hatter, "and you shall have no tea until you have solved this puzzle! I have before me two cups, each filled with the same amount of liquid, one with coffee and the other with tea. I now take a teaspoonful of coffee from the coffee cup and pour it into the tea cup and thoroughly mix the two together. Now, I take a teaspoonful of this mixture and pour it into the coffee cup. Your problem, my dear Alice, is to determine if there is more coffee in the tea cup, or, more tea in the coffee cup?"

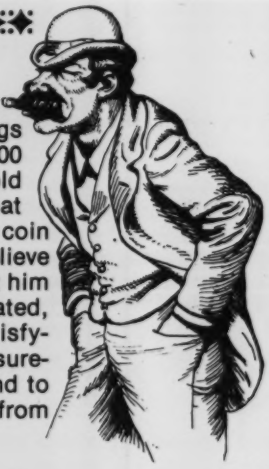
(From Richard M. Weed, Trenton, New Jersey)

AN EASY PROBLEM

Let's change the puzzling page with an easy (?) word problem from Bill Mooney of Old Bridge, New Jersey. Bill asks the question; what **one** word may be inserted in the blanks below to form valid, new words?

_____ an, _____ bug, _____ id, _____ bled, _____ or, _____ us.

THE CASE OF THE BOGUS DOUBLOONS

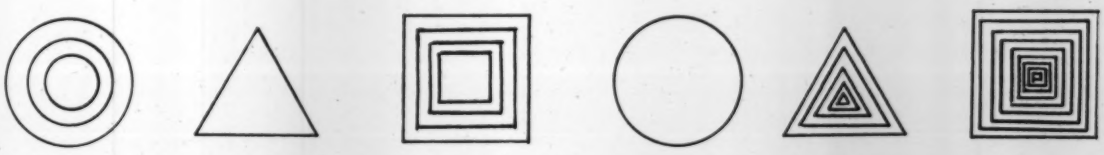


That world famous sleuth, J. Pinkerton Snoopington, has an interesting tale to tell. It seems that he bagged a crooked international courier, with 50 bags of gold coins, at an airport in the couriers own country. Each bag contained 100 coins and it was Snoopington's contention that the courier had switched the gold coins in one of the bags for worthless counterfeit coins. Snoopington knew that each genuine gold coin weighed exactly one ounce, and, that each counterfeit coin weighed exactly 1/7 of an ounce less. The authorities tended not to believe Snoopington, but, when he said that he could prove his case if they would let him have the use of the luggage scale they agreed to give him a chance. They stipulated, however, that he would be given only one opportunity to use the scale. After satisfying himself that the scale was true to within a hundredth of an ounce of measurement Snoopington proceeded to prove to the authorities that he was right and to show them the bag that contained the bogus coins. How was he able to do this from only one reading off the scales?

(From Tarus Paul Balog, Asheboro, North Carolina).

WHAT COMES NEXT?

Our last puzzle is from the pen of David Day of Newton Centre, Mass. Pictured below are six random (?) patterns made up from circles, triangles and squares. Your problem is to figure out what the next three patterns in the series are. Ready, on your mark, get set, ...draw!



GENESYS

Jay G. Elkes

In the beginning, there was chaos and the Universe was without form and void. The Lord looked upon His domain and decided to declare His presence. "I be" he said, then to correct his grammar added "am."

If the Lord had decided to work on irregular verb conjugation first this wouldn't have happened. God would later curse the English language for its part, but in that moment I.B.M. came into being.

The Lord looked out upon the I.B.M. He had created and said "This is good." That's what He said, but He shook his head, wondered what the boys at the User Group would say, split the light from the dark and went to bed. Thus passed the Beginning and the end of the first day.

On the second day, the Lord summoned I.B.M. unto His presence. "There is chaos out there, and the Universe is without form and void. I must correct this and I can use your help. Is there anything you can do for me?"

"I can take care of form," I.B.M. replied. "Put me in charge of computers and I will take care of form for you."

The Lord thought that this was good and said "Let there be computers. Let I.B.M. have my powers of creation that pertain to computers and form." Thus saying, the Lord went off to His second day's work while I.B.M. created the 1401.

On the third day, while the Lord was out, I.B.M. decided to subdivide the assigned task. "Let there be systems that make the computer work and let them be called Operating Systems. Let there also be systems that make use of the computer and let them be called Application Systems." Thus, there came into being both Operating Systems and Application Systems, but there were no programmers.

The next morning I.B.M. had to give the Lord a status report.

"What did you do yesterday?" the Lord asked.

"I invented the operating system" I.B.M. replied.

"You did?" the Lord shuddered. "Oh dear."

"Yes I did," I.B.M. confirmed, "but I find I need something you alone can provide."

"And what is that?"

"I need programmers to use my computers, to operate my operating system and to apply my applications."

"That can't be done now," said the Lord. "This is only the fourth day and there won't be people until the sixth day."

"I need programmers and I need them now. If they can't be people they can't be people, but we have to work this out today."

"Give me some specifications and I'll see what I can do." I.B.M. hastily worked up specs for programmers (are specs ever anything other than hasty) and the Lord reviewed them.

The Lord knew the specs weren't sufficient but followed them anyway. He also made some programmers that did just what programmers were supposed to do, just to spite I.B.M. The programmers and I.B.M. spent the rest of the day creating the Assembler and FORTRAN. On the morning of the fifth day, I.B.M. reported to the Lord once again.

"The programmers you created for me have a problem. They want a programming language that is easy to use and similar to English. I told them you had cursed English, though I still don't know why. They wanted me to ask your indulgence on this."

The Lord had cursed English for good reason, but didn't want to explain this to I.B.M. He said "let there be COBOL" and that was that.

On the status report of the next day I.B.M. announced that computers had gone forth and multiplied. Unfortunately, the computers still weren't big enough or fast enough to do what the programmers wanted. The Lord liked the idea of going forth and multiplying, and used the line Himself later on that day. This sixth day being particularly busy, He declared "Let there be MVS" and there was MVS.

On the seventh day God had finished creation and computers had COBOL and MVS. The Lord and I.B.M. took the day off to go fishing. I.B.M. hung a sign on the door to help programmers in his absence.

IF AT FIRST YOU DON'T SUCCEED, TRY TRY AGAIN — AND HAVE THE FOLLOWING READY BEFORE CALLING I.B.M. This was the start, and by some accounts the end, of I.B.M. documentation.

On the start of the second week the programmers went over I.B.M.'s cathode ray tube directly to God.

"We have a horrible problem," they complained. "Our users want systems that perform according to their expectations."

"Users!" the Lord bellowed. "Who said that you should have users! Users are the difference between good and bad applications, a function I have reserved unto myself! Who authorized you to have users?"

"Well, I.B.M..."

"I.B.M.! You! You did this to my programmers! You gave them the knowledge of good and evil. For that you shall suffer through eternity!

"Let there be competition. Let it be called Anacom, and Burroughs, and C.D.C."

The Lord went through the alphabet several times. "With all this competition you shall still suffer the pain of antitrust legislation all the days of your existence."

This was the start of the second week, and it seems an appropriate place to conclude our report. In case you missed something, a summary of key points follows.

Users and their needs are and always have been a subject of dispute. Nobody can learn English because it is cursed by God. I.B.M. manuals are doubly cursed and therefore twice as hard to understand. Of the programming languages, only COBOL can claim divine origin. People are people, but programmers are something else.

Computers may be a gift from heaven, but there's no divine help in getting them to work. Because of I.B.M.'s initial assignment, there are more forms than anyone knows what to do with. Finally, chaos was part of the original state of the Universe and not a product of the data processing industry. □

ATTENTION TRS-80'S

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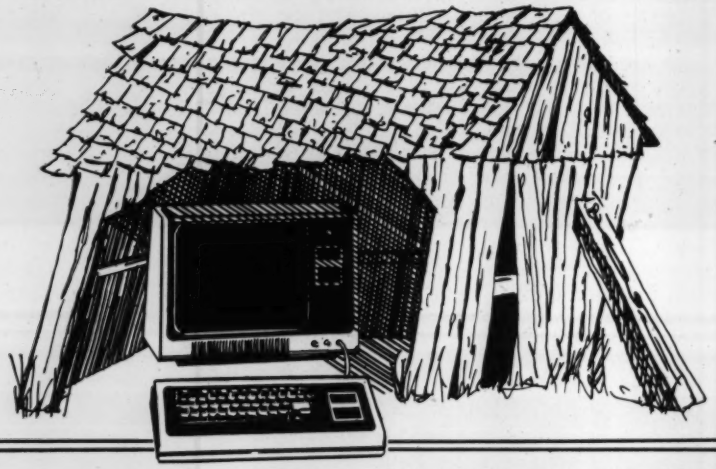
TRS-80 Strings

Stephen B. Gray



For this eighth chapter in the TRS-80 story, let's take a look at why CP/M won't be implemented on Radio Shack's Little Wonder, at a new magazine for the serious programmer, some cassette albums for storing your programs, the SAM76 language, a short program that superimposes letters on a sinewave, a file-handling program, and a $475 program.

No TRS-80 CP/M

Radio Shack has officially killed the idea of using CP/M on the TRS-80. There is no suitable way of relocating CP/M from the low end of memory, and CP/M expects I/O vectors at 0 to 100 hex.

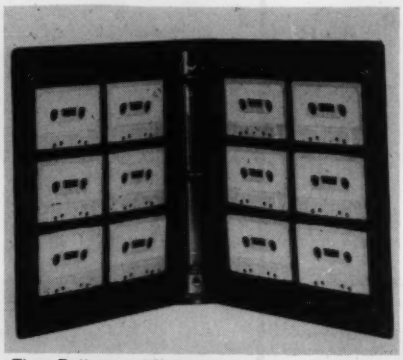
This could be programmed around, but all the machine-language programs written under CP/M would then be unusable. Although BASIC programs will work under CP/M, since they don't use those vectors, "machine language is where the real value of CP/M is," according to a Radio Shack software executive.

The only solution would be for Radio Shack to support a different, parallel version of CP/M but, as the executive put it, "We don't get any advantage out of being able to run CP/M BASIC. Microsoft BASIC programs run on either TRSDOS or CP/M, with only a minor change in the OPEN statement. The advantage of having our own version of CP/M would be very small for the amount of support we'd have to give it."

PROG/80

The publishers of SoftSide (**Creative Computing**, Jan. 1979, p. 28) now have a second magazine, PROG/80. Whereas SoftSide "has always specialized in general-interest BASIC software," as the forward to the first issue of the new magazine puts it, PROG/80 is "dedicated to the serious programmer," according to the front cover. For the small businessman, BIZ-80 is on the way.

The first issue of PROG/80, dated March 1979, is full of useful information, with articles on how to use strings (STRING$ FEVER), modifying your TRS-80 to display lower case, a routine that uses PEEK to find all the variables used in a program, Getting the Most Out of DATA Statements, a Micro Monitor that uses POKE to put a short machine-language program into memory, a much longer program that does the same thing but also includes several extra features and which is also a disassembler, useful tricks for using INKEY routines, a program that manipulates the clock available with disk BASIC, and how to program graphics easily and fast by using the DEBUG routine to modify strings in memory to include graphic characters.



The Reliance 12-cassette ring binder for holding program documentation is at left; the other is the six-cassette dust-tight album.

This new quarterly magazine is exactly what many TRS-80 users have been looking for, and is well worth the $10 a year. Subscription inquiries should be addressed to: PROG/80 Subscription Manager, P.O. Box 68, Milford, NH 03055. The single-issue front-cover price is $3.

Cassette Storage Albums

In the January 1979 column (p. 29) I described a Radio Shack music-cassette storage album you can use for your program cassettes.

Since then I've heard from Reliance, the country's largest manufacturer of cassette albums. They've decided to offer five models for program storage, at retail prices, with a minimum order quantity of three.

Two of the albums are ring binders, for holding program documentation, and storing six or 12 cassettes; two others are similar, without the rings, but with a pocket for documentation, for three or six cassettes; the fifth is a six-cassette album that closes tightly.

Prices range from $2.30 to $5.95 each, plus sales tax for NY residents, from Reliance, Plastics and Packaging Division, 108-18 Queens Blvd., Forst Hills, NY 11375. Ask for a spec sheet.

The 12-cassette ring binder, CA2LL-12, at $5.95, is a natural for storing your programs with the documentation, keeping them all together in one place, instead of scattered around your "computer room." The $3.40 CA2-6N album is nice for carrying cassettes to a club meeting, or to a friend's house, or for just plain dustproof storage. The cassettes snap in and out of the compartments quite easily, and the album has dust-tight overlapping trays, with one

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Mail List I by Michael Kelleher is the economy model of disk-based mailing list programs. Uses a single drive and handles up to 1400 names per disk, plus provisions for sorting options. - 16K, D $19.95

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Small Business Bookkeeping by Roger W. Robitaille, is based on the Dome Bookkeeping Journal, sold for years in stationery and discount outlets. Level II, 4K with ($22.00) or without ($15.00) Dome journal.

Inventory System II by BIZ-80 Proper inventory management is the backbone of a profitable business, yet it's very difficult to keep current on price increases, shrinkage, low-on-stock items, profitable items versus losers, without an efficient and prompt method of surveying your inventory levels at any given time. This program can help you to achieve optimal management — it can handle up to 1,000 items on one disk; each additional disk can handle another 1,000 items. With Documentation, $150.00

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Lance Micklus

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KVP Extender by Lance Micklus Corrects keyboard bounce, upper case lock, permits use as a terminal, screen printing. On tape ($24.95) or disk ($29.95)

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MISCELLANEOUS

Diskettes Dysan 104/1 Box of five, $24.95 + $1.00 shipping Verbatim, box of ten, $34.95 + $1.00 shipping/handling

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The BASIC Handbook by Dr. David A. Lien $14.95 + $1.00 shipping/handling

SIMULATIONS

3-D Tic Tac Toe by Scott Adams Three skill levels — author warns you to practice before tackling computer's third skill level. L I or II, 16K $7.95

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fitting into the other, plus a snap-lock closure that keeps the album closed.

SAM76

"The SAM76 language is a general-purpose macro generator operating in an interpretive mode interactively with the user." That's the first line of the notes that accompany the TRS-80 version of SAM76, and if you don't understand the sentence, then perhaps you aren't ready for SAM76, or need to do a little more reading in computer software.

Those who do understand it are sure to find SAM76 of interest. SAM76 was first described in a 1976 paper, and has since been implemented on several personal computers, including the TRS-80, operating in either Level-I or Level-II.

SAM76, written by the pseudonymous Ancelme Roichel, has over 150 functions, and can perform rather powerful operations in areas such as text manipulation and editing, simulation, and arithmetic with any desired precision. SAM76 is a string processor, which means that the units of information are not confined to any fixed length.

Not much point in going into any detail on SAM76 here, since it's mainly of interest to hardcore software buffs, who can get the newly revised and enlarged manual of about 250 pages for $15, and a TRS-80 cassette of SAM76 for another $15, from SAM76 Inc., Box 257 RR1, Pennington, NJ 08534. (SAM76 is also available on cassette for the Poly 88, and on CP/M diskettes.) The **Adventure** game is now available in a bilingual SAM76 version on CP/M diskette for $15; you choose at the beginning whether to play it in English or in French.

Just a few samples of SAM76 to whet your appetite. To add two and four, just input

```
%AD,2,4/=
```

and the system interprets % as the start of an expression, AD as addition, and / = as the signal to execute.

Since SAM76 is a recursive language, the factorial function is simple to implement in recursive fashion, using only this

```
%IG,1,[1],1,!%MU,[1],&FAC,%SU,
      [1],1/////
```

which sets up the factorial function so that to compute factorial 5, you need only input a very short line to generate the answer:

```
%FAC,5/=120
```

and if you think you can fool SAM76 by asking for factorial 100, what a surprise to find that after a short wait, SAM76 cranks out a number almost three lines long across the screen, with 24 trailing zeros! SAM76 will also give you the hundredth power of 2, which is a 31-digit number, in a rather short time, based on an algorithm not much longer than the factorial function. Three short lines are enough to write **Towers of Hanoi** in SAM76.

These samples are all too skimpy to indicate the real power of SAM76, which for $30 you can investigate to your heart's content, learning all about functions such as fetch field, hide text, neutral implied, plot (with a bunch of plotter subfunctions), pad string, rotate the bits, set data, trim, and over a hundred more.

Short Program #3

This program floated around **Creative's** office for some months before I snagged it. In the original, the first line is a PRINT statement that suggests the program was written by one of the inmates: ANOTHER FANTASTIC APPLICATION FROM CREATIVE CONFUSION!! Various comments were inscribed on the printout as the program went from hand to hand, such as "Remember, a program is a terrible thing to waste (Abe Lincoln to his grandmother)," and others too obfuscatory to mention here.

```
100 CLS
110 Z$="THETRS-80DIDIT"
120 FOR A=0 TO 6.5 STEP .5
130 X=20*SIN(A)
140 M=M+1
150 PRINT TAB(X+30);MID$(Z$,M,1)
160 NEXT A
```

The program prints the Z$ string sinusoidally, and runs only in Level-II. For printer output, Z$ can be increased in length, which means also increasing the maximum value of A.

The last handwritten note on the original program is perhaps one form of a programmer's blessing (or curse?): "May the wart hogs be with you."

Circle Enterprises

A Connecticut company, Circle Enterprises (Box 546, Groton, CT 06340) offers several extensive business programs for use by a distributor a dozen games programs at $5.95 each, and a couple of short business programs, such as loan payment/amortization. All are for Level-I and Level-II, except for the 16K File Handling program, which is for Level-II only.

File Handling, according to the documentation, "allows the user to set up a 100-name file with fields and up to 80 characters per record. You can then store the file onto cassette." The full name of the program is User Programmable File Handling.

File Handling takes less than a minute to load. On RUN, a few seconds are taken up with INITIALIZING, and then you're asked IS THIS A NEW FILE? If your answer is NO, then the program asks you to READY DATA FILE CASSETTE (PLAY), PRESS ENTER TO BEGIN.

If your answer is YES, a menu comes up on the screen:

```
1 - INPUT DATA
2 - LIST NAMES IN FILE
3 - SEARCH/EDIT FILE
4 - RECORD FILE ON CASSETTE
0 - EXIT FROM PROGRAM
```

On 1, you get an entry form for a telephone-directory type of file, with spaces for name, address, telephone number, and remarks. This is in the program as an example of how the fields can be used for file handling. You can use the tape to create your own telephone directory, or change the field names for the type of file you prefer.

To create a telephone directory, you enter the information, which you can use later in several ways. Option 2 on the menu simply lists the names and telephone numbers, alphabetically by last name. Option 3, search/edit, allows you to "enter enough letters to identify name," so that if there is only one last name beginning with a Z, then entering a Z will pull out that name and also display all the information filed under that name.

You can then show all the data for the next name in the file, or for the previous file, by pressing N or P, or go back to search mode by pressing S, or edit the file by pressing E to get into edit mode, or D to delete the entire record on display. In edit mode, you select the line to be edited: name, address, city, telephone number, or remarks.

To change the program so you can use it for some other type of file, simply LIST, and change the appropriate PRINT, DATA and associated lines.

File Handling is a useful program that does the job quite neatly and with a minimum amount of work.

$475 Program

The first programs available for the TRS-80 were relatively inexpensive, at $5 for a simple game up to $30 for the editor/assembler. Prices and complexity have risen, starting with the $50 set of 100 programs from The Bottom Shelf, pausing at $350 for Microsoft's FORTRAN, and reaching what may be tops, for the moment anyway, at $475 for SSP.

SSP is a Shipping Schedule Program, "for warehouse applications where up-to-date shipping information is required," with "provisions for creating, maintaining, printing, and storing the shipping schedule." The minimum TRS-80 configuration necessary for SSP is a line printer (Radio Shack or Centronics 779), one disk drive, and the expansion interface with 16K bytes of RAM for a total of 32K bytes.

SSP includes a TRSDOS-compatible diskette and user's manual, from Edward R. Kittlaus, Computer Consultants, Dept. CC, Box 2175, Seal Beach, CA 90740.

If any of you readers should purchase SSP, please send me comments on it.

The Bottom Shelf, incidentally, notes in the booklet that accompanies "The Library 100" that "most of our planned future software will require at least one disk unit, and 32K of memory (L print modes will be available)." Onward and upward. □

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Apple-Cart

Richard A. Milewski

Apple 3-D Graphics (that's right, 3-D!)

Dick Milewski is president of The Software Works, Inc. (P.O. Box 4386, Mt. View, CA 94040), a company which has developed several application packages for North Star disk-based systems. They are currently developing similar application programs for the Apple.

It is only natural with the high resolution graphics capabilities of the Apple II that considerable interest has evolved in making line drawings on the screen. Drawings of two dimensions are, of course, quite easy to produce. Three dimensional objects may be drawn by a process called projection. The study of this process, and indeed the very concept of the two dimensional perspective drawing, was one of the prime preoccupations of the worlds great artists and mathematicians during the Renaissance. Figure 1 is a woodcut done in 1525 by Albrecht Durer. Done for his treatise on geometry it shows one of the first devices for "mechanically" producing a two dimensional image of a three dimensional object. The two men are plotting the image of the lute as it would be seen from the point on the wall where the small hook is located. The string defines the path of the light from a point on the lute to the hook. As the man on the left places his end of the string on various points on the lute the man on the right notes the point at which the string passes through the plane of the image as defined by the picture frame. The hinged drawing board is then swung into place and the location of the string's intersection with the plane is marked with a dot. This device was one of the earliest pre-cursors of modern computer driven plotters.

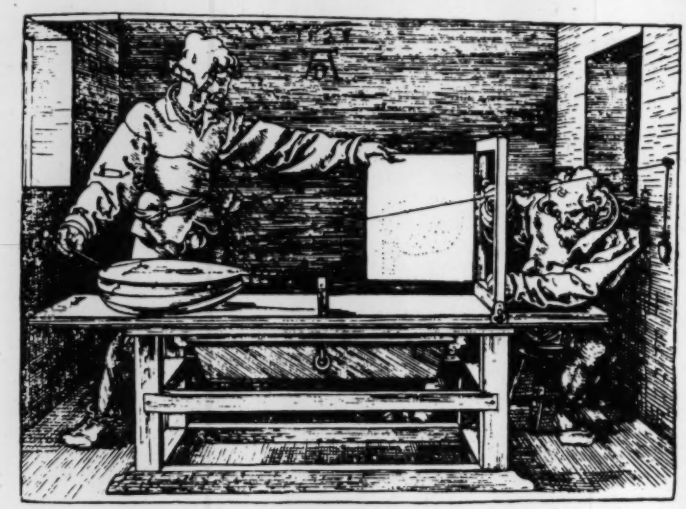

Figure 1. Albrecht Durer Woodcut.

It was not until the nineteenth century that the problem of constructing a three dimensional image from two dimensional data began to attract much attention. In 1838 Professor Wheatstone invented the reflecting stereoscope, with some minor modifications by Sir David Brewster it became an ubiquitous form of parlor entertainment throughout the middle nineteenth century. The operation of the stereoscope is dependant upon delivering to each eye an image which differs in angular perspective from the image delivered to the other. In the Brewster stereoscope this is done by using a lens to focus a separate image on each eye. There was a revival of popularity in stereo images in the 1950's when the technique of using crossed polarizing filters was used to produce motion pictures in three dimensions. The fad died rather quickly but a few 3D productions were done in the 1960's and in the case of one or two "adult" films as late as the early 1970's. A horror film starring Vincent Price titled "The House of Wax" stands as the most remembered of the 3D films. At about the same time as the early 3D films a fad swept the world of the pre-teenagers — Three Dimensional Comic Books! The technique was to print the comics as line drawing in red and green ink and to supply with each book a pair of cardboard framed glasses with lenses made of red and green plastic film. A whole generation of youth spent entire summers seeing the world in shades of red and green, much to the distress of their parents who were sure that the practice would result in blindness if not insanity.

3-D Images With The Apple

It is the technology of the 3D comic book which is almost directly transferrable to the high resolution screen of the APPLE II. To view the output of this month's programs it will be necessary to construct a pair

of red/green glasses. Figure two shows a pair made from some red and green plastic film available at most dime stores, and a pair of 35mm slide mounts which are usually available singly for a few cents each at photo supply stores. Those of you who just happen to have a few old 3D comic books around can of course use the glasses which came with them.

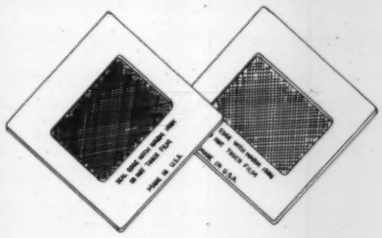

Figure 2. 3D Glasses.

The next step is to adjust the tint and color controls on your monitor so that the lines drawn in high resolution graphics will be red, green and white instead of the green, blue and white displayed by a properly adjusted set. (Newer APPLES may produce the desired results by using the values 5 and 6 in the HCOLOR statements instead of 1 and 2.) Some fiddling with the contrast and brightness controls may also be necessary. The object is to produce red lines which are nearly invisible when viewed through the green filter and vice versa. Once this has been achieved simply run the program (HIRES Graphics in 3-D) and then view the results through the filters. It seems to work better if you don't look at the image on the screen until the filters are in place on the bridge of your nose.

The technique described above is not the only approach to the three dimensional image problem. It would seem a rather simple matter to produce 3D images using the classical two picture Brewster approach. The advantage to this approach would be the ability to produce color images in either high or low resolution graphics and the disadvantage is that the Brewster stereoscope does not lend itself to group viewing. Another method might be to cover each half of the screen with polarizing material (cross polarized of course) and view the result with the traditional 3D movie specticles. This might, however, require more eye muscle control than most people are capable of in order to get the two images to fuse into one.

The possibilities for applications of the three dimensional images are a bit limited, but a clever programmer should be able to create a space war game with enough realism to make the player duck when attacked by an enemy missile. OK, all of you latent entrepreneurs, here's your chance! Write the ultimate space war game, send it to us, we'll review the best of the lot here and pass the best two or three onto Creative Computing Software for possible publication. Not only will you become famous, but a few royalty checks may help pay for your system.

Software Review

Program Name: SCRAMBLEDEGGS

Written by: Royce Jones

Publisher: Brahman Diversions
1075 Space Parkway
#330, Mt. View,
California 94040

Price: $14.95

In looking over the rapidly growing selection of software available for the Apple, it sometimes happens that one stumbles upon a program which is not remarkable in its function, but is so elegant in its implementation that it deserves special attention. Such a program is SCRAMBLEDEGGS by Brahman Diversions. When this little gem was first described to me, my first reaction was that I really wasn't interested in another word guessing game. But SCRAMBLEDEGGS isn't just another word guessing game. The author has implemented a disk based, anagram-like game which not only provides eleven levels of difficulty but also keeps a statistical summary of every game ever played on that particular disk. The user can compare his score with the average score for any given level of difficulty. SCRAMBLEDEGGS even keeps a set of averages for each player so he/she can compare current and past performance at the various levels. The program is a masterpiece in ease of use and shows what can be done when someone gives some thought to the best way to use the capabilities of a computer for a task, rather than merely providing a minimum solution.

Software Rating

1 = Poor 2 = Fair

3 = Good 4 = Excellent

Documentation = 3
Utility = 3.5
Ease of Use = 3.5
Creativity = 3.5
Over All Rating = 3.5

□

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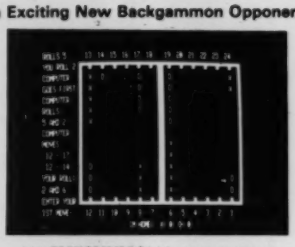

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Personal Electronic Transactions

Gregory Yob

I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.

The PET hardware and software market has expanded quite a bit, and in the light of this, I have decided to concentrate on PET **techniques** and to lay off of listing all of the goodies that come by my desk. As a farewell to this, some comments on the last batch of PET items:

The big C (Commodore) has published a PET User Manual, and is now offering the Pet Users Club Newsletter (formerly the TRANSACTOR - I recall the day we were trying to come up with something more dignified than The Sandbox...and chose TRANSACTOR.) Neither of these new publications impress me very much.

TIS, P.O. Box 921, Los Alamos, New Mexico, 87544, offers a series of workbooks that will introduce the beginner to the PET. They serve this purpose fairly well.

Len Lindsay is offering the BEST of The PET Gazette ($10.00) - from PET Gazette, 1929 Northport Dr., Rm. 6, Madison, WI 53704.

Robert Purser offers the Reference List of TRS-80, PET and Apple II Computer Cassettes for $4.00 (P.O. Box 466, El Dorado, CA 95623). This lists all known advertised PET software, reviews a few and reminds you to let the buyer beware!

CGRS Microtech, Box 368, Southampton, PA, 18966 offers a S-100 bus adaptor and a minifloppy disc system for the PET.

Connecticut microComputer, 150 Pocono Rd., Brookfield, CT 06804, offers some interfacing hardware for the PET IEEE port. Their DAM is a multiplexed D/A and A/D converter for the PET.

The Channel Data Book, Channel Data Systems, 5960 Mandarin Ave., Goleta, CA, 93017 is a list of PET software and hardware. They provide a notebook for insertion of new material and an update service.

The Vagaries of Floating Point

If you are new to computers, this section might be a little difficult for you - so skip forward if you want to.

There are times when your PET will misbehave when working with numbers. Donald Cox mentioned some examples of this - so let's take a look:

Enter this direct command into the PET:

```
FOR J = Ø TO 1Ø STEP .1:PRINT J: NEXT
```

The last few lines of printout will look like this:

```
9.5
9.6
9.7
9.80000001
9.90000001
```

This erratic behavior will start at approximately J = 3 and happen on and off from there.

The PET stores numbers in a form called "normalized binary floating point." Some examples in decimal will show how this works. The number 123 can be seen as .123 times 10^3. This can be shown as:

```
3    .123
```

where the 3 is the exponent on the base (10) and .123 the mantissa, where the value of the number is stored. Here are some more examples:

```
12.45   becomes  2    .1245
.0035   becomes -2    .35
```

Numbers less than one are moved over until there are no leading zeroes. This leads to (in binary) the fact that all fractions in binary will start with the digit 1. Here are some examples - note that the exponent is a binary number indicating the **binary** exponent:

```
111111     becomes 110 .111111    (110 is 6, for 26)
1010.1010  becomes 100 .10101010
```

Since the first digit is always a 1, it is ignored (that is, implied), and the exponent is changed by one - the examples above become:

```
111111     becomes 101 .11111      (for 1.11111)
1010.1010  becomes 011 .0101010    (for 1.0101010)
```

This works out well for integer numbers, and for any fraction whose denominator is a power of two. If you tried:

```
FOR J= 0 TO 10 STEP 1/16 :PRINT J:NEXT
```

all would work correctly.....

However, remember what happens to 1/3 — it becomes .3333333... in decimal. Well, 1/10 is a repeating fraction in binary. This means that the binary number for 1/10 (our original STEP in the first FOR-NEXT example) cannot be represented **exactly** in the PET. When this number is added again and again, the error will appear in visible form after some 30 additions. In short, the PET isn't adding 1/10 each time, but is adding some slightly different number (a very tiny amount smaller) instead.

The cure for FOR NEXT loops is to make sure the STEP value is an integer, or a fractional power of 2, like 1/4, 1/8, etc. The example could be changed to:

```
FOR J = 0 TO 100:PRINT J/10:NEXT
```

and all will go well.

Why didn't we see this error sooner? The PET doesn't display the last few bits of its numbers (I think it is 5 bits, or 1½ digits) to help with the accuracy of the displayed result. This works most of the time, unless deliberately abused, as we were doing above.

The PET's hidden bits can lead to some ominous and very hard to find bugs. Here is a typical nasty one:

```
A = 1.2345678912346

B = 1.2345678923456

PRINT A,B
 1.23456789          1.23456789

IF A=B THEN PRINT"HATCH"

READY.
```

Though A and B will PRINT the same value, they are different in the "hidden digit" and the equality test will give "not equals." The moral is to always use greater than or less than for tests if you are adding fractions together!

Oh yes, a last nasty on this:

```
FOR J = 1 TO 2 STEP .1:PRINT J: NEXT
 1
 1.1
 1.2
 1.3
 1.4
 1.5
 1.6
 1.7
 1.8
 1.9

READY.
```

What happened to J = 2, which should be executed as well? If you tried FOR J = 10 TO 20 STEP 1 instead, the numbers 10 through 20 will appear, or 11 steps instead of the 10 above. The error comes from the .1 STEP value, again. The cure is to add half the STEP value to the upper limit, (i.e., FOR J = 1 TO 2.05 STEP .1) and all will work as expected.

Some Screen Gymnastics

The PET's display can be used in some unusual ways in programs. If something is already on the screen, you can move the cursor into the already printed line and use it for inputs. Here is an example:

```
10 PRINT"clr";
20 INPUT"TYPE SOMETHING:";A$
30 PRINT"YOU TYPED: sp"A$
40 PRINT"hm";
50 INPUT A$
60 GOTO 30

RUN
(screen clears)

TYPE SOMETHING ? HI THERE CHARLIE
YOU TYPED: HI THERE CHARLIE.
```

The cursor will now be in the P in the top line. If you enter RETURN, the screen will now show: (With the cursor in the P again)

```
?YPE SOMETHING? HI THERE CHARLIE
YOU TYPED: PE SOMETHING? HI THERE CHARLI
E
```

The second time you pressed RETURN, the entire first line starting with the P was INPUT and displayed on the second line.

This can be used to help foolproof the PET in a game and to give the novice user a clue for what to do. Here is a fragment that could be put into a game:

```
10 PRINT"clr sp THIS IS THE GAME OF ZARQUIL"
20 PRINT"hm dn dn dn ENTER YOUR Z-ATTRIBUTE";
30 PRINT" sp sp sp HELP lft lft lft lft";
40 INPUT A$
```

When this is RUN, the cursor will be in the H in HELP. If the user just presses RETURN, A$ will be set to "HELP." This is a graceful way to "fix" the tendency of the PET to stop a program if you enter RETURN only in an INPUT statement.

I once used this trick to provide some sample numbers for a plotting program, where the user didn't have any idea what value to enter for a nice plot, and his guesses usually resulted in no plot at all.

If a game were to keep a cumulative record, like the fastest time or record score, this trick can be extended to making changes in the program itself. Here is a trivial example:

```
10 PRINT "clr TRIVIAL GAME"
20 READ NG,HS
30 PRINT"hm dn dn GAMES PLAYED"NG
40 PRINT"dn HIGH SCORE"HS
50 INPUT"dn dn DO YOU WANT TO PLAY?";A$
60 IF A$<>"YES" THEN END
70 PRINT"clr YOU HAVE NOW PLAYED THE GAME"
80 PRINT"dn PRESS 'RETURN' WHEN THE SCREEN CLEARS
90 FOR J=1 TO 3000: NEXT
100 PRINT"clr dn dn 500 DATA"NG+1","HS+INT(12*RND(1))
110 PRINT"SAVE"CHR$(34)"TRIVIAL"CHR$(34)
120 PRINT"hm";
500 DATA 0,0
```


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PET con't...

When you RUN this program, the values NG (Number of Games) and HS (High Score) are read from the DATA in Line 500 and displayed. When you "play" the game, the instruction to enter "RETURN" after the screen clears is given. Lines 100 and 110 draw two commands onto the PET screen, and Line 120 homes the cursor. You will see:

```
READY.
500 DATA 1 , 5                    (the second number might vary)
SAVE"TRIVIAL"
```

with the cursor in the 5 of 500. If you press RETURN twice, the data in Line 500 will be entered into the program, and then the PET will save the program on tape. If you clear the screen, and RUN again, "TRIVIAL" will now report that it has been played once already, keeping track from RUN to RUN!

A closer look at Lines 100 and 110 will be useful when you try this trick in your own programs. If you home the cursor, and then END the program, as in Line 120, the cursor will end up in the **third** line of the PET display. The PET always prints a carriage return, a READY and another carriage return when a program ends. In Line 100, the sequence "clr dn dn" clears the screen (a good idea if stuff is already on the screen) and moves the cursor down to screen line 3. Later, when the program does the home and ends, the cursor will now be in the right place.

Since the DATA line needs a comma between the two numbers, the commas have to be explicitly printed. That's why the "," is put between the two numbers.

In Line 110, there is a trickier problem: the SAVE command needs a quotation mark in order to start the program name. CHR$(34) will do a quotation mark.

Leapfrog and Some Other Tricks

The implications of being able to enter any BASIC statement from a program (with the user pressing RETURN) are quite large. Here are a few examples for you to try and discover what they do:

Example 1: Leapfrog

```
10 PRINT"clr THE LEAPING FROG"
20 PRINT"dn dn HOW MANY HOPS?";
30 INPUT H
40 IF H<1 OR H>20 THEN PRINT"1-20 PLEASE":GOTO 20
50 PRINT"clrPRESS 'RETURN' TO HOP YOUR FROG"
60 PRINT"dn GO TO" 1000- 10*INT(H)
70 PRINT"hm";:END
800 PRINT"HOP"
810 PRINT"HOPPITY"
820 PRINT"HOP"
830 PRINT"HOP HOP"
840 PRINT"MC HOPPER"
850 PRINT"**LEAP**"
860 PRINT"HOP"
870 PRINT"CROAK"
880 PRINT"HOPPY"
890 PRINT"HOP"
900 PRINT"HOPEROO DE HOPPO"
910 PRINT"HOP"
920 PRINT"RIBETTT!!!!"
930 PRINT"HOP"
940 PRINT"HIPPY HOP HOP"
950 PRINT"SKIP"
960 PRINT"HOP"
970 PRINT"JUMP"
980 PRINT"HOP"
990 PRINT"GLOP"
1000 PRINT"PLOP - ONE TIRED FROGGIE!"
```

Example 2: On The Line

```
0 GOTO 60000
60000 INPUT"clr START LINE NUMBER:";SL
60010 INPUT"LINE # INCREMENT sp :";IC
60020 IF FL=0 THEN 60050
60030 READ SL,IC,FL
60040 DATA 0,0,0
60050 PRINT"clr dn dn";
60060 PRINT"60040 DATA"SL+10*IC","IC",1"
60070 FOR J=SL TO SL+9*IC STEP IC
60080 PRINT J;
60090 GOSUB 61000: NEXT J
60100 PRINT "RUN 60030 hm";
60110 END

61000 GET A$: IF A$="" THEN 61000
61010 PRINT A$;
61020 IF A$<>CHR$(13) THEN 61000
61030 RETURN
```

You can improve this one by adding a false cursor, but beware! The PET's "Quote Mode" will get you for sure! If you solve this one, send me a copy.

Example 3: A Functional Use for This

```
10 PRINT"clr MINIPLOTTER"
20 PRINT"dn ENTER A FUNCTION TO BE PLOTTED IN THE"
30 PRINT"FORM:
40 PRINT"dn sp sp sp sp sp sp sp sp Y = F(X)
50 PRINT"dn WITH F(X) A VALID BASIC EXPRESSION.
60 PRINT"sp sp FOR EXAMPLE,"
70 PRINT"dn sp sp sp sp sp sp sp sp Y = 12*SIN(X)*X
80 INPUT"dn dn dn dn FUNCTION:";F$
90 PRINT"clr NOW PRESS 'RETURN' TWICE..."
100 PRINT"dn 200"F$
110 PRINT"RUN 150 hm";
120 END
150 FOR X=0 TO 1000 STEP .1
200 REM DUMMY FOR INSERTED FUNCTION @ RUNTIME
210 PRINT TAB(Y);"*"
220 NEXT X
```


CMC

PET ANALOG INPUT

DAM SYSTEMS

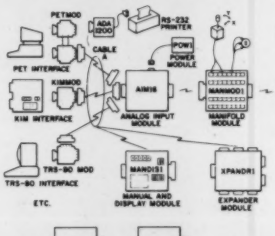
Analog to Digital Conversion System for the Commodore PET Computer

Give the PET the ability to sense, measure, and control the world around it with DAM SYSTEMS modules. Just plus the PETSET1 into the PET to get 16 channels of analog input. Screw terminals are provided for each channel so you can hook up joysticks, pots, or whatever appropriate sensors you have.

Each of the 16 analog inputs, in the range of 0 to 5.12 volts, is converted to a decimal number between 0 and 255 (20 millivolts per count). Conversion time is 100 microseconds.

In addition, the PETMOD provides two IEEE ports and one user port as well as a DAM SYSTEMS port.

Software is provided. A one line program is all that is necessary to read a channel.



PETSET1

1 - AIM161	-	16 ANALOG INPUTS - 8 BITS - 100 MICROSEC
1 - PETMOD	-	PET ADAPTER - 2 IEEE PORTS - 1 USER PORT - 1 DAM SYSTEMS PORT
1 - CABLE A24	-	24 INCH INTERCONNECT CABLE
1 - MANMOD1	-	MANIFOLD MODULE - SCREW TERMINALS FOR INPUTS, REFERENCE, GROUND
1 - POW1	-	POWER MODULE

PETSET1a for 110 VAC $295
PETSET1e for 230 VAC $305
Order direct or contact your local computer store.

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BROOKFIELD, CONNECTICUT 06804
TEL: (203) 775-9659 TWX: 710-456-0052

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ADD $3 PER ORDER FOR SHIPPING & HANDLING - FOREIGN ORDERS ADD 10% FOR AIR POSTAGE.

CIRCLE 144 ON READER SERVICE CARD

Have fun with these - many improvements are possible. One small trick is to use a FOR-NEXT loop to print the line numbers of the Screen Gymnastics code so you can remove the code with RETURN when you are finished. Another one is to print instructions for a long game, and then to RETURN out the instructions lines when it is time to play the game, thus saving some space.

As a last example of screen gymnastics, here is a program that PEEKs memory and makes DATA statements with the memory values in the data. I have used this program the most in my personal library to load small machine language programs for use by a BASIC program (via SYS).

```
DATA MAKER PROGRAM

10 PRINT"clr DATA MAKER FROM MACHINE LANGUAGE":INPUT"dn
    START ADDR, END ADDR";S,E
20 INPUT"dn FIRST LINE #, INCREMENT";F,I:GOTO 40
30 READ F,I,S,E
40 PRINT"clr PRESS 'RETURN' TO ENTER DATA":PRINT"dn dn";
50 FOR L=1 TO 20:PRINT F"DATA sp";:FOR D=1 TO 7:
    PRINT MID$(STR$(PEEK(S)),2);
60 S=S+1:IF S>E THEN 100
70 IF D=7 THEN PRINT: GOTO 90
80 PRINT",";:NEXT D
90 F=F+I:NEXT L:PRINT"RUN 30 hm dn dn 110 DATA"F
    ",";"I",";"S",";"E"hm";:END
100 PRINT:PRINT"RUN 120 hm dn";:END
110 DATA 1000 , 1 , 826 , 900              (dummy data line)
120 PRINT"clr PRESS 'RETURN' TO REMOVE NON-DATA dn":
    FOR J= 10 TO 130 STEP 10: PRINT J
130 NEXT J:PRINT"hm";:END
```

(Note: The long lines in the listing are indented for reading convenience and aren't entered that way.)

Lines 10 and 20 tell what the program is, and asks for the first and last addresses to be PEEKed by the program. Line 20 asks for the first DATA line number and the increment between DATA line numbers. Line 30 is skipped - later the program will restart with Line 30.

Line 40 clears the screen and prints a reminder for you to press RETURN, then position the cursor to the third screen line. Line 50 begins a loop (L) to print 20 DATA lines on the PET screen. First, the DATA line number and the word DATA is printed. Then an inner loop (D(PEEKs seven memory locations and prints them on the line as integers from 0 to 255. (Seven 3-digit numbers are the maximum that can be put into a 40 character DATA line.) The MID$ function snips off the leading blank that STR$ makes when it converts a number to a string.

Line 60 checks to see if all the memory cells have been PEEKed.

Line 70 checks if 7 data items are printed. If so, Line 80, which prints the comma between data items, is skipped.

Line 90 adds the increment 1 to the line number, F, and ends the L loop (the 20 lines loop). When the L loop ends, the RUN 30 instruction is tacked to the bottom (the 21st line), and the DATA line 110 is generated at the top of the screen - and the program ENDs. Now you are to press RETURN and enter the DATA lines, including Line 110 which holds the new values for line# and starting PEEK address among other things.

In the case that the program has finished its PEEKs, Line 100 places a different RUN command, RUN 120 at the bottom of the DATA lines on the screen. Now, when RUN 120 is executed, Line 120 prints the reminder on the top line, and then the line numbers in this program, 10 to 130. Pressing RETURN now removes the program, leaving you with only the DATA lines you wanted!

Making All This Automatic

I am sure you have discovered that the PET can store a few characters entered before a GET or INPUT statement is executed. For example, try the following:

```
10 PRINT"TYPE STUFF IN NOW"
20 FOR J=1 TO 10000 :NEXT     (yes, ten thousand!)
30 PRINT"OK, STOP"
40 INPUT A$
50 PRINT A$
```

If you RUN this, and enter HELLO and RETURN before Line 30 is executed, you will see:

```
RUN
TYPE STUFF IN NOW              (you enter HELLO and RETURN)
OK, STOP
? HELLO
HELLO

READY
```

The PET has stored the letters you typed in while the loop in Line 20 was executing. The PET's capacity is 10 characters. When the 10th character is entered, all 10 vanish. Here are some examples:

012345678	gives	012345678	(9 characters)
0123456789	gives	(null)	(10 characters)
0123456789ABCDEF	gives	ABCDEF	(16 - 10 chars)

Now, somewhere in the PET, these characters are stored and we can PEEK and POKE these locations:

CMC

KIM ANALOG INPUT

Analog to Digital Conversion System for the KIM Computer

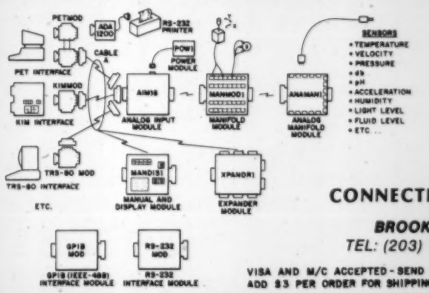
DAM SYSTEMS

Give the KIM the ability to sense, measure, and control the world around it with DAM SYSTEMS modules. Just plug the KIMSET1 into the KIM to get 16 channels of analog input. Screw terminals are provided for each channel so you can hook up joysticks, pots, or whatever appropriate sensors you have.

Each of the 16 analog inputs, in the range of 0 to 5.12 volts, is converted to a decimal number between 0 and 255 (20 millivolts per count). Conversion time is 100 microseconds.

The KIMMOD provides one user port as well as a DAM SYSTEMS port.

Software is provided.



KIMSET1

1-AIM16I	- 16 ANALOG INPUTS - 8 BITS - 100 MICROSEC
1-KIMMOD	- KIM ADAPTER - 1 USER PORT - 1 DAM SYSTEMS PORT
1-CABLE A24	- 24 INCH INTERCONNECT CABLE
1-MANMOD1	- MANIFOLD MODULE - SCREW TERMINALS FOR INPUTS, REFERENCE, GROUND
1-POW1	- POWER MODULE

KIMSET1a for 110 VAC $ 285
KIMSET1a for 230 VAC $ 295

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CIRCLE 144 ON READER SERVICE CARD

PET con't...

LOCATIONS 527 to 536 hold the characters typed in. LOCATION 525 holds the count of the characters.

We can take a "dynamic" look at these locations with this little program:

```
10 PRINT"clr BUFFER ZAPPER"
20 PRINT"hm dn dn sp sp sp sp sp sp sp sp sp sp
     sp sp sp sp sp sp sp sp sp sp"
30 C=PEEK(525)
40 PRINT"hm dn dn"C;
50 IF C=0 THEN 20
60 FOR J=1 TO C
70 PRINT CHR$(PEEK(526+C));
80 NEXT J
90 GOTO 20
```

A RUN of this program will show the input buffer and how it changes as you enter characters from the keyboard (with some odd stuff after RETURNs).

The fun really begins when POKEing this input buffer is done. If you will recall, pressing RETURN to any line on the PET's screen will ENTER THE ENTIRE LINE!

Clear your PET screen, and enter the sequence shown below. The READY printouts (followed by a period) will be provided by the PET.

```
PRINT"hm";
READY.
FORJ=527TO536:POKEJ,13:NEXT

READY.
POKE925,9           (After this one, you will have to home
                    the cursor and using Cursor Down, put the
READY.              cursor below the READY.)
A$="PRINT A$"

READY.
PRINT A$
PRINT A$                    (The PET provides this one)

READY.
PRINT"hm";
```

Now the screen will flicker a bit and some "snow" will appear. The PET has a series of six direct commands, and the RETURN's forced into the input buffer to make the PET execute all of these. Since two of these refill the input buffer with RETURNs, the PET is now in an infinite loop without any GOTOs! (How about that!) Of course, pressing STOP will get you out of this.

The PET will let you fill the buffer from a program and when the program ends, the PET will then do any commands that are on the screen (up to 9 of them). This can be combined with the screen gymnastics to automate many of the tricks shown earlier. I leave it as an exercise to change the screen gymnastics examples to use this feature. And, since I like Alice in Wonderland, here is a Cheshire Cat for you.

(Note: Letters which are underlined or in boldface are to be shifted when entered into the PET for the corresponding graphics character).

```
10 PRINT"clr dn dn dn dn dn dn dn dn dn
20 PRINT"sp sp sp sp sp sp sp sp sp sp sp sp sp sp
     OMNM dn MN up NMNP
30 PRINT"sp sp sp sp sp sp sp sp sp sp sp sp sp sp
     M dn MNM dn MN up NMN up N
40 FOR J=527 TO 536:POKE J,13: NEXT: POKE 525,9
50 FOR J=1 TO 4000: NEXT: PRINT"clr dn dn";
60 FOR J= 10 TO 80 STEP 10: PRINT J: NEXT
70 PRINT "?"CHR$(34)"clr"CHR$(34)
80 PRINT"hm";
```

□

PET WORD PROCESSOR

This program permits composing and printing letters, flyers, advertisements, manuscripts, etc., using the COMMODORE PET and a printer.

Script directives include line length, left margin, centering, and skip. Edit commands allow the user to insert lines, delete lines, move lines and paragraphs, change strings, save onto cassette, load from cassette, move up, move down, print and type.

The CmC Word Processor Program addresses an RS-232 printer through a CmC printer adapter.

The CmC Word Processor program is available for $29.50. Add $1.00 for postage and handling per order.

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CIRCLE 144 ON READER SERVICE CARD

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- Low-Byte Selection Operator
- Source statements of the form: [label] [opcode] [operand] [;comment]
- 56 valid machine instruction mnemonics
- All valid addressing modes
- Equate Directive
- BYTE Directive to initialize memory locations
- WORD Directive to initialize 16-bit words
- PAGE Directive to control source listing
- SKIP Directive to control source listing
- OPT Directive to set select options
- LINK Directive to chain multiple text files
- Comments
- Source listing with object code & source statements
- Sorted symbol table listing

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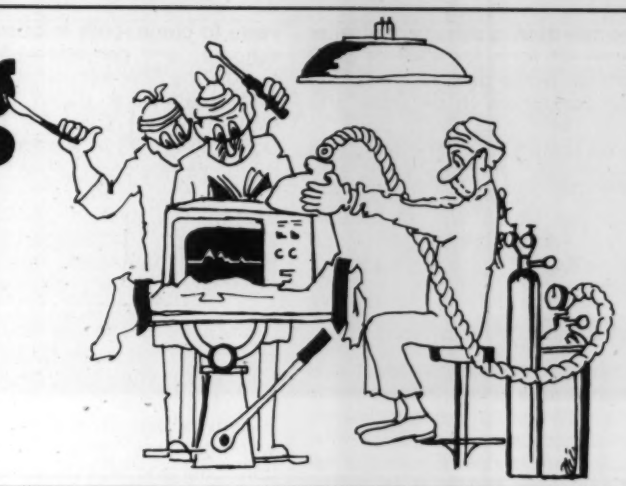
CIRCLE 178 ON READER SERVICE CARD

Operating Systems Q&A

John Craig



North Star Double Density DOS

I've got to admit that I had some misgivings about going to double density. On the one hand I was looking forward to it, because there have been several times when I've run out of room on a single density diskette. On the other hand, I'm from the old school which says, "If it's running okay, don't mess with it!" I just knew with my luck something was going to go wrong. Not so... everything went very smoothly.

Some people are under the impression that double density involves doubling the number of tracks on a diskette. Actually, it's the **capacity** of existing tracks which has been doubled, rather than the number. There are 35 tracks with 10 sectors per track. Single density allows 256 characters of data per sector for a total of 89,600 per diskette (256 x 10 x 35). Assuming 3 line items in an inventory system requires approximately 128 characters, a single density diskette will handle about 2,000 items (6 x 10 x 35 = 2,100). Double density shoves 512 characters of data into each sector, thereby doubling the capacity to 179,200 characters per diskette (or, over 4,000 items in an inventory system).

The mechanics of switching over to double density involved removing the cover from my Horizon, removing the single density controller and inserting the new controller in its place. The new system diskette (Horizon DOS Ver. 5) was inserted... and up it came! There have been rumors circulating, which may be true in some cases, that the drives might require modification to work in the double density mode. Mine didn't... and both have been working like clockwork. (I checked with North Star on that matter and was told that the majority of drives are working fine with the double density controller. However, in the event they need to be retrofitted with a new motor, and other components, the cost is $145).

Getting the software all "straightened out" can be simple or require a little bit of effort. The new DOS and BASIC will read single density programs from another diskette without any problem. Therefore, a person could elect to simply have one or two system diskettes and use those for loading and running all the single density software which has been accumulated. I personally prefer to have the system, and some of the new and improved utilities in version 5, on a diskette along with the programs I'm going to be running. As a result, I went to the trouble of putting the system on each diskette... and, in doing so, got all my software (about 45 diskettes) organized very nicely. I also wound up with a handful of spares.

Some of those new utilities include improved copy disk and copy file routines, a density select routine and a new compact routine.

```
NORTH STAR DOS 5.0                    That quick, and you're already into
+GO CPM                                a "pseudo" CP/M system!

CP/M on North Star double density disk
22K Version 1.44
Copyright (C) 1979 Lifeboat Associates

A>DDT CONFIG.COM
DDT VERS 1.4
NEXT PC
0B00 0100
-S120
0120 FF 83          83 = North Star Horizon
0121 FF .
-G100                  Single byte changed (loc
                       120) in CONFIGuration
CONFIG Version 1.5     program to indicate
Copyright (C) 1979 Lifeboat Associates   system being used
Your CP/M System is now configured.      (in this case, a North
Type SAVEUSER to permanently save on disk. Star Horizon).
A>SAVEUSER

Saveuser Vers 1.2 - for North Star double density.
Saves mode byte and 2 sectors starting at user area.
Copyright (C) 1978 Lifeboat Associates
                                  New system saved on
Place CP/M SYSTEM DISK into drive A: and   disk by simply
type RETURN to patch (or ^C to not patch)  running SAVEUSER
                                           program.
User area patching completed.
A>

Up & running in newly configured CP/M system!
```

Figure 1. North Star Double Density.

The new double density controller comes in kit form for $349 or $399 assembled. Some dealers are taking the old controllers in on trade and reselling them (you might want to check on that). Oh, by the way, this new controller will also work with North Star's upcoming "Quad-Density" drives which will be double density and double-sided. (North Star Computers, 2547 Ninth St., Berkeley, CA 94710).

Double Density CP/M on North Star

Lifeboat Associates have outdone themselves this time. They've come up with such a simple, user-oriented, double density version of CP/M that it's a pleasure to use. Figure 1 illustrates just how simple it is to get going. You can be up and running in CP/M almost immediately because they offer thirteen different configurations which can be patched in as easily as changing location 120 to the value which corresponds to one of those versions. If you don't have one of those thirteen hardware configurations (unlikely) then it will require some additional effort to get it going, but they've tried to make that as smooth as possible, also.

The old, single density version of CP/M didn't have a formatting program (it was necessary to go back into the North Star DOS to format diskettes). The new version has such a program, plus a new density selection routine (to allow the reading of single density diskettes) and a new copy utility...something else that was missing before.

Most of the software available for CP/M on North Star is serious business application material. Upgrading to double density appears to be a logical step in the right direction toward overcoming the capacity shortcomings of mini-drives.

$145 will buy it (or, $25 for the documentation alone) and the address is Lifeboat Associates, 2248 Broadway, New York, NY 10024.

Tidbits

In a recent conversation with George Morrow, of Thinker Toys, I was told that he's in the midst of developing a version of Bell Lab's UNIX operating system for the 8080. This major undertaking will come about through the talents of Gary Fitts...a very sharp programmer. The appearance of UNIX on the micro scene is very timely because of its multi-tasking capability and other features. This is definitely one of the major directions we'll be going in the years to come (both in business and schools...and, perhaps even homes).

Are you Sorcerer owners ready for CP/M? It's here. Photo 1 is a 24K system photographed at Computer Components #3 in Westminster, CA running a version of CP/M from Meca (7026 O.W.S. Road, Yucca Valley, CA 92284). The system consists of a single North Star (Shugart SA-400) or MPI B-51 mini-disk, the Sorcerer expansion, Meca's double density controller ($299) and the software. CP/M sells for $98 and they also have Microsoft Disk Basic ($195) and Fortran ($500). Their controller supports up to four drives and will run double density on any drive which has been working fine with single. The controller and MPI drive, with power supply and cables, sells for $699. In addition to Computer Components stores in the Los Angeles area, CP/M on the Sorcerer is also available through Computer Lab of New Jersey (141 Route 46, Budd Lake, NJ 07828). There are probably more. Give Meca a call at 714-365-7686 and find out where they are.

Photo 1
The Exidy Sorcerer...feelin' good with CP/M.

Ron Anderson (3540 Sturbridge Ct., Ann Arbor, MI 48105) has started a FLEX User's Group for 6800 owners using that operating system. The first issue of his newsletter was 21 pages long and filled with useful information including several programs. Drop him a line and ask about subscription rates and how often he'll be publishing. (Whatever you do, don't let it die!).

If you've been looking for an IBM to CP/M conversion program, then look no further. Starr Computer Systems, 8010 Hascall St., Omaha, NE 68124, has a program for $99.95 which will convert an EBCDIC file from an IBM 3740 Data Entry System diskette to an ASCII CP/M diskette and vice versa. (I suspect a lot of readers would be interested in seeing a review written on this package).

A CP/M "expansion" is available from Micro Computer Applications & Hardware (MICAH), P.O. Box 22212, San Francisco, CA 94122, which provides the following additional functions to a standard CP/M system or Cromemco CDOS: 1.) Read Console with no echo; 2.) Format Name to File Control Block (builds a disk file anywhere in memory); 3.) Link to User Program (allows one COM file to call another COM file); 4.) Sixteen-bit multiply and divide. It's called the MICAH CP/M Expander...and I don't have the price. (Another candidate for an objective review).

We've got a new member to our "staff." In the initial list of experts who will be handling questions coming in for this column (Nov/Dec '78 issue) I somehow left out Micropolis. Jim Molenda, their Product Support Specialist, dropped me a note offering his services...and pointing out my shortsighted error. With the increase in popularity for their tremendous capacity drives, along with their MDOS operating system, it was quite a goof. My apologies. Now let's see if we can keep Jim busy with some questions.

We should also include Vector Graphic and their MZOS operating system which was designed for Micropolis drives. I'm sure I could throw any questions on MZOS in Bob Hart's direction, and he would be happy to answer them.

I guess by now most of you Heath system owners have heard about CP/M for the H8? It's coming from Lifeboat Associates (164 W. 83rd St., New York, NY 10024). (Actually, by the time this gets to press, it will probably be here!)

I made a statement in a recent article about Cromemco's CDOS being CP/M compatible. According to Cris Rook, of Cromemco, the old CDOS is not fully CP/M compatible but their new version will be (and that should be available now). The new version will also have a utility disk which will allow modifying the BIOS and directory in an interactive mode.

Those Cards and Letters...

A letter from Bill Perry (Traverse Co., P.O. Box 392, Whitinsville, MA 01588) asks about the availability of CP/M for his Level-II TRS-80. Well, we've got two sources for you to choose from, Bill. I might suggest you drop a line to both and ask for their literature and check out the features before making your decision. FMG Corporation, P.O. Box 16020, Fort Worth, TX 76133, has a version which sells for $150 (includes the set of 6 CP/M manuals). Tell Don French I said "hi" when you write or call, okay?

Q & A, con't....

(One of Don's distributors is Cybernetics, Inc., 8041 Newman Ave., Suite 208, Huntington Beach, CA 92647. They offer a free "CP/M Printer" you might want to send for. They've got TRS-80 applications software, too). You can also get CP/M for the TRS-80 from Lifeboat Associates, Suite 505, 164 West 83rd St., New York, NY 10024 ($145, which includes CP/M documentation). They have a version, which is compatible with FMG's, which runs on the TRS-80 mini-disk and another version for the 8" diskette. The standard-size system uses George Morrow's Disk Jockey controller and drive (1201 10th St., Berkeley, CA 94710) and the TRS-80 expansion from HUH Electronics (1429 Maple St., San Mateo, CA 94402). Something to keep in mind with all of these TRS-80 CP/M's is that none of them are compatible with the bulk of software which has been developed for standard 8" CP/M systems (S-100, in most cases). The reason is because the TRS-80 firmware (the monitor in PROM) is situated down in lower memory, which is usually used by CP/M. Therefore, the TRS-80 CP/M's were developed around this "obstacle." With the large amount of software available from both Lifeboat and FMG, this may not be a problem, but, it's something to be aware of.

Bill Heitman (5262 Mississippi Bar Dr., Orangevale, CA 95662) dropped us a line asking about the availability of a tape-oriented files management system for his Exidy Sorcerer. He complained mildly that it seems everything is disk-oriented and he's really more interested in going with a high-speed tape system. The Beta-1 from Meca (7026 O.W.S. Road, Yucca Valley, CA 92284) will do the trick. It sells for $399 (assembled & tested). A single drive will hold up to 1 megabyte (but I believe that's with the double density option, which is an additional $50). Data transfers are at 500 bytes per second with access times typically around 10 seconds. The worst case is something like 39 seconds which is not bad at all. Besides, it's fun watching a Phi-Deck do its thing, at least you get to see it in operation. You can't say the same for disk systems. They have a new double-speed system in the works which will increase the transfer rate up to 2K per second (with double density). An 8-bit parallel interface is standard, which should connect to the Sorcerer with little or no trouble, and an RS-232 serial interface is available for an additional $50. The system comes with a self-contained operating system.

A postcard from an indistinguishable signature said that he (or she) was thinking about obtaining a Compucolor II and was wondering about their operating system and whether there was a version of CP/M for the system. Compucolor hasn't heard of a CP/M that has been developed for their system, and, frankly, don't see any need for it. They feel their operating system is quite adequate and has plenty of features. Walt Degler, a member of the Compucolor technical staff, spoke with me about their system and I'm sure we can bother him with any questions that pop up in the future. (We have a review of the Compucolor II in the process which should be coming up in the near future). □

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RSM-2: AN ADVANCED MONITOR FOR 16K TRS-80'S - 26.95
RSM-2D: THREE MONITORS FOR TRS-80 DISK SYSTEMS - 29.95

22 commands to control your TRS-80 Z-80 processor! Examine ROM's, test RAM, program in machine language, read/write machine language tapes, and much more! A SYMBOLIC DUMP command disassembles memory into Z-80 mnemonics! Display memory in HEX or two ASCII formats, or EDIT, MOVE, EXCHANGE, VERIFY, FILL, ZERO, TEST, or SEARCH your memory! RSM-2/2D include all above features, plus read/write SYSTEM tapes, enter BREAKPOINTS, PRINT with our TRS232 or the expansion interface, and read/write disk sectors directly! RSM-2 loads at the top of 16K LEVEL I or II. RSM-2D, furnished on disk, has 3 versions for 16K, 32K and 48K.

BASIC-1P - LEVEL-1 BASIC WITH PRINTING! - $19.95

Run any LEVEL-1 BASIC tape (12K or less) in 16K LEVEL-II TRS-80 without conversion! Plus LLIST and LPRINT for TRS232, RS-232-C or Centronics printers. LPRINT ON and LPRINT OFF prints anything that you see on the screen! All LEVEL-I abbreviations and functions supported.

BARRICADE: MACHINE LANGUAGE ACTION GAME FOR TRS-80'S - $14.95

Break through 5-wall Barricade with high-speed ball and keyboard controlled paddle! Trap the ball among the walls and watch it destroy the 100 blocks! Select 96 different options to challenge experts and beginners. 3 scores with the best of each saved to be challenged by other players. NOBODY can achieve the maximum WEIGHTED SCORE of 33,000! 4K LEVEL-I and II.

AIR RAID: MACHINE LANGUAGE TRS-80 SHOOTING GALLERY! - $14.95

Shoot down high speed aircraft with a ground based missile launcher! Aircraft explode dramatically when hit, sometimes destroying other nearby planes! Score is tallied for each hit or miss, and the highest score is saved to be challenged by other players. Hours of fun for you, and a super demonstration program for entertaining friends! 4K LEVEL I and II.

TRS232 PRINTER INTERFACE - $49.95 (+$2.00 shipping)

Assembled and tested output port for TRS-80 printing. Use any RS-232 or 20-mil current loop ASCII printer. Expansion interface not required. Use with LEVEL-II BASIC, CP/M, BASIC-1P, ELECTRIC PENCIL, RSM-2/2D or your own programs! Standard cassette software included, or order new "FORMATTER" for $9.95 with TRS232 (see below).

TRS232 "FORMATTER" SOFTWARE PACKAGE - $14.95

Page and line length control, form feed function, printer pause, 9 baud rates, "smart" line termination, built-in keyboard debounce, software control of screen printing, etc. $9.95 if ordered with TRS232.

THE ELECTRIC PENCIL FOR TRS-80 DISK SYSTEMS - $150.00
THE ELECTRIC PENCIL FOR TRS-80 TAPE SYSTEMS - 99.95

Write text, delete, insert, or move words, lines or paragraphs, save text on tape (or disk), then print formatted copy with our TRS232 or Centronics printer (RS-232-C with disk version). Right justification, page titling and numbering, transparent cursor and repeating keyboard. Lowercase entry and display with minor modification. LEVEL-I or II 16K (Tape version).

CP/M OPERATING SYSTEM WITH TRS232 SOFTWARE - $145.00

SMALL SYSTEM SOFTWARE/LIFEBOAT ASSOCIATES version of CP/M. Includes TRS232 and RS-232-C software, lower-case support, debounce, plus DCV-2 and other unique utilities. CP/M Editor creates and modifies all files. Files may be much longer than your memory! Assemble directly from disk, placing HEX and PRINT files back onto disk! Includes DDT (Dynamic Debugging Tool), PIP (Peripheral Interchange Program), and more! 16K single disk required, 32K dual disk recommended.

DCV-1: CONVERT SYSTEM PROGRAMS TO DISK FILES - $9.95

Execute Adventure, Barricade, Air Raid, RSL-1, ESP-1, T-BUG, etc., from disk, even if they interfere with TRSDOS! After using DCV-1, your program loads from disk into high memory, moves itself to its correct address, then jumps there and executes!

OTHER TRS-80 PRODUCTS

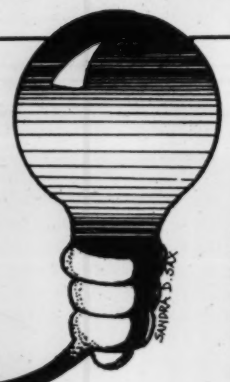
ESP-1: $29.95 Editor, assembler, and monitor using INTEL 8080 mnemonics.
RSL-1: 14.95 Draw patterns, then play Conway's LIFE in machine language.
LST-1: 8.00 A disassembled listing of LEVEL-1 BASIC with some comments.

* CALIFORNIA RESIDENTS ADD 6 PER CENT SALES TAX *
* SMALL SYSTEM SOFTWARE * P.O. BOX 366 * NEWBURY PARK, CALIF. 91320 *

* SMALL SYSTEM SOFTWARE * P.O. BOX 366 * NEWBURY PARK, CALIF. 91320 *

CIRCLE 193 ON READER SERVICE CARD

Compleat Computer Catalogue



We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

SOFTWARE

TINY-C INTERPRETER

Tiny c associates has announced the availability of the tiny-c interpreter and Program Preparation System in six new formats: TRS-80 cassette, CP/M 8" soft-sectored and Micropolis 5" dual or quad density diskette; North Star DOS 5" single density diskette; and a PDP-11 to 8080 cross-assembled version.

The TRS-80 cassette version is recorded in Level-II System format and includes line printer and graphics support. It also reads and writes EDTASM compatible files. $30. The North Star version loads at 2A00. Both the CP/M and North Star diskettes cost $35. The PDP-11/8080 diskette includes the Program Preparation System and costs $35.

Tiny c associates, P.O. Box 269, Holmdel, NJ 07733, (201) 671-2296.

CIRCLE 225 ON READER SERVICE CARD

FORTH SOFTWARE DEVELOPMENT PACKAGE

Forth, Inc., has introduced polyFORTH, a programming language to cut software development time for mini- and microcomputers and reduce memory requirements. The standard polyFORTH package requires only 4K bytes of memory with an additional 2K bytes for the assembler and the text editor. polyFORTH is available for the TI9900 and 8080, and is running in a custom environment on an Intel 8086. The product is designed for disk-based systems.

Forth, Inc., 815 Manhattan Ave., Manhattan Beach, CA 90266, (213) 372-8493.

CIRCLE 226 ON READER SERVICE CARD

MOTOROLA M6809 EMULATOR

E6809 is a 6800 machine language program that will emulate all of the functions of the Motorola 6809 third generation microprocessor. Developed for use on any 6800 computer system, the program allows software development and debugging prior to 6809 availability. 6809 object code may be placed in the 6800's memory and executed or single-step traced by E6809. The 3K byte program is complete with a 6809 mini-monitor and console I/O routines for ease of use. Specify Smoke Signal Broadcasting or FLEX disk, or KCS cassette. $49.95.

The Micro Works, P.O. Box 1110 Del Mar, CA 92014, (714) 756-2687.

CIRCLE 227 ON READER SERVICE CARD

MSI MULTI-USER BASIC

MSI Multi-User BASIC contains most of features of Version 1.4 of the BASIC Interpreter. It runs under the SDOS Operating System only and operates in the interpretive mode. Under the Multi-User System, a maximum of four users can be on the system at a given time. Each user has complete access to disk data files simultaneously. A version is available which employs the intelligent features of the MSI RAM-16 16K Memory Board. This will allow a 16K partition for each user program. MSI recommends the use of the HD-8/R 10 Megabyte Fixed/Removable Disk Storage System to provide the greatest speed and reliability of the Multi-User Operation System.

Midwest Scientific Instruments, Inc., 220 West Cedar, Olathe, KS 66061, (913) 764-3273.

CIRCLE 228 ON READER SERVICE CARD

The basic need of the creator is independence.—Ayn Rand

STRUCTURED BASIC

Ultimate Computer Systems announced SBASIC (Structured BASIC), a pre-compiler. SBASIC provides 14 additional statements for program control and readability.

SBASIC generates code in the Microsoft Disk Extended BASIC syntax, and is available now on CP/M compatible diskette for $50.00 or as a BASIC source listing for $35.00.

Ultimate Computer Systems, 313 Meadow Lane, Hastings, MI 49058, (616) 945-5334.

CIRCLE 229 ON READER SERVICE CARD

LOOKUP-DATA MANAGER

Mycroftware Systems has announced an easy to use data manager for users of the flex operating system. Lookup works with data records with the ability to add, delete, inquire, create, print, list, and purge records.

Data records may be of variable length with a variable number of fields. Data files may also be edited for complex changes to records. Data is also accessible from BASIC for mathematical manipulations or custom reporting. Disk and manual, $49.95.

Mycroftware Systems, P.O. Box 1138, St. Charles, MO 63301.

CIRCLE 230 ON READER SERVICE CARD

DEBUGGING SOFTWARE FOR 6800

Percom Data Company has announced six programs for the 6800 microcomputer. The programs are: a relocating assembler and linking loader, tape-$50.00, disk-$55.95; a relocating disassembler and segmented source text generator, tape-$35.00, disk-$40.95; a disassembler/Source generator, tape-$25.00, disk-$30.95; a disassembler/trace, tape-$20.00, disk-$25.95; a relocator, tape-$20.00, disk-$25.95; and, a monitor on a 2716 - $70.00

Percom Data Company, 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE 231 ON READER SERVICE CARD

LABEL-BASIC

LABEL-BASIC, a new language, acts as a pre-processor to translate programs written in LABEL-BASIC into programs utilizing a BASIC interpreter or compiler. As an extension of most versions of BASIC, it also provides the capability of descriptive line labels and variable names. $59.95.

Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91361, (213) 889-9340.

CIRCLE 232 ON READER SERVICE CARD

MICROSTAR WORD PROCESSING INTEGRATED WITH DATA PROCESSING

The MICROSTAR Word Processor operates under the STARDOS multi-user operating system which provides for all your data processing needs including order entry, accounting and inventory control. Form letters can be typed once and stored on diskettes. Mailing lists can be maintained on the MICROSTAR System. All functions are controlled by a single key stroke. In addition, keys were chosen to be easy to remember - F is for Forward, B is for Back, U is for Up, and so forth. If the operator forgets a command, the menu for all command actions can be reviewed.

Micro V, 17777 SE Main St., Irvine, CA 92714, (714) 957-1517.

CIRCLE 233 ON READER SERVICE CARD

GENERAL ACCOUNTING SYSTEM

A General Accounting System for the Microstar Small Business System has been announced by Micro V Corporation. It is a complete bookkeeping system including General Ledger, Accounts Receivable, Accounts Payable, Payroll, Mail List and Word Processor.

Micro V, 17777 SE Main St., Irvine, CA 92714, (714) 957-1517.

CIRCLE 234 ON READER SERVICE CARD

COMPLETE ACCOUNTING SYSTEM

The Space Byte Computer Corporation, has released an interactive accounting system, the Assistant Bookkeeper. A complete method of financial management for small businesses, The Assistant Bookkeeper includes comprehensive General Ledger and Accounts Payable packages. Optional modules for the accounting system include Accounts Receivable with order entry and inventory reporting, and Payroll. All modules have complete audit trails and all transactions are posted to the General Ledger as they occur, keeping the G/L current to generate up-to-the-minute financial reports. Complete systems including dual disks, terminal and line printer cost under $12,000.

Diskette Business Machine, Office Products Div., Space Byte Computer Corp., 6464 Sunset Blvd., Suite 530, Los Angeles, CA 90028, (213) 468-8080.

CIRCLE 235 ON READER SERVICE CARD

LANGUAGE FOR ACCOUNTANTS

A Natural Accounting Language (NAL) designed by accountants for accountants has been announced by Miningham & Oellerich, Inc. For reports, the user communicates his requirements directly to the system. Multi-company P&L's, balance sheet, regulatory, cash flow, product line profitability, statistical and trend reports are readily available.

The Natural Accounting Language (NAL) was written in COBOL, and designed for both main frame and mini-computers.

Miningham & Oellerich, Inc., 1212 Avenue of the Americas, New York, New York 10036, (212) 921-2360.

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CIRCLE 143 ON READER SERVICE CARD

MAILMASTER PROGRAM

MailMaster, to simplify processing and management of mail lists for use of the Sol computer has been announced by Processor Technology. Using a disk as the memory medium, the program provides storage of up to 5095 names, addresses and other data in a single list. Each entry can consist of up to 1000 characters distributed among a maximum of 99 lines. $395.

Processor Technology, Inc., 7100 Johnson Drive, Pleasanton, CA 94566, (800) 227-1241, in CA (800) 972-5951.

CIRCLE 237 ON READER SERVICE CARD

BUSINESS FORECASTING FOR PDP-11

The Forecast IV system is designed to generate the forecast line when a set of dual statistics is entered into a computer. Written in BASIC for a PDP 11 minicomputer, this analytical package sells for $235.00, including documentation, source, and media.

RSI, 140 Sylvan Ave., Englewood Cliffs, NJ 07632, (201) 947-6104.

CIRCLE 238 ON READER SERVICE CARD

BASIC ETC SOFTWARE

Percom Data Company has announced BASIC ETC, a BASIC language interpreter for 8080/Z-80 systems using cassette storage. The program requires

9.5K bytes of RAM. Features include integer, real and string variables capability, integer constants range of -32,767 to +32,767, real constants from n x 10-62 to n x 1062 with the number of significant digits selectable from 6 to 72, 11 string commands and functions, n-dimensional arrays, program line numbers from 1 to 65,567, direct memory and I/O addressing, detects error conditions, outputs 27 error messages, and character and line erasure during input. $35.

Percom Data Company, 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE 239 ON READER SERVICE CARD

SORCERER PROGRAMS

Public Computing, Inc., has announced six cassette programs for the Exidy Sorcerer. Programs available are: Blackjack; Biorhythms; Sub/Ship Chase Game; Compucards, a personality test and fortune telling program; Atom, an inductive logic program in which rays are sent into a black box and are then deflected, reflected, and/or absorbed; and MAP, a three mode program which displays a map of the United States with each state outlined, plots individual states on command, and offers a CAI State Capital quiz. $9.95 each or $19.95 for a set of any three.

Public Computing, Inc., #10 North Earl Ave., Lafayette, IN 47904, (317) 447-9439.

CIRCLE 240 ON READER SERVICE CARD

MEMORY TYPEWRITERS

Most mini and micro systems can do double duty as intelligent or memory typewriters with a CAPDOC, Computer Assisted Preparation of Documents, software family written in 8K BASIC. The package consists of CAPDOC/Intelligent Typewriter, CAPDOC/Memory Typewriter, and a Diablo Printout Guide. $34.95.

Monoson Microsystems, Inc., P.O. Box 97-K, Watertown, MA 02172.

CIRCLE 241 ON READER SERVICE CARD

NORTH STAR "PASSWORD" FEATURE

North Star users can have a "password" added to their DOS and BASIC. This allows authorized access to your disks. The package is on a mini-disk containing: DOSP, modified NS DOS,

APPLE II® PROFESSIONAL SOFTWARE

LISA INTERACTIVE ASSEMBLER

LISA is a totally new concept in assembly language programming. Whereas all other assemblers use a separate or co-resident text editor to enter the assembly language program and then an assembler to assemble the source code, LISA is fully interactive and performs syntax/addressing mode checks as the source code is entered in. This is similar in operation to the Apple II Integer BASIC Interpreter. All error messages that are displayed are in plain, easy to understand English, and not simply an Error Code. Commands in LISA are structured as close as possible to those in BASIC. Commands that are included are: LIST, DELETE, INSERT, PR #n. IN.#n, SAVE, LOAD, APPEND, ASM, and a special user-defineable key envisioned for use with "dumb"peripherals, LISA is DISK II based and will assemble programs with a textfile too long to fit into the Apple memory. Likewise, the code generated can also be stored on the Disk, hence freeing up memory for even larger source programs. Despite these Disk features, LISA is very fast; in fact, LISA is faster than most other commercially available assemblers for the Apple II. Not only is LISA faster, but also, due to code compression techniques used LISA requires less memory space for the text file. A full source listing containing the object and source code are produced by LISA, in addition to the symbol table.

Apple II 32K/Disk $34.95

PROGRAMMA Software Products

PROGRAMMA INTERNATIONAL, Inc.
3400 Wilshire Blvd. Los Angeles, CA 90010
(213) 384-0579 / 384-1116 / 384-1117

CIRCLE 178 ON READER SERVICE CARD

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Patches to connect Thinker Toys 8" Disk Drives to North Star DOS & Basic. Fully supports all North Star Functions on 8" disk.

$49.95

CSUB

A set of Functions defined in North Star Basic that handle all disc accessing (Sequential, Random, & Keyed Access) and all CRT display, formatting & Input. A SUPERB APPLICATION PROGRAM DEVELOPMENT PACKAGE.

$49.95

TIMESHARE

Patches to North Star DOS & BASIC that take advantage of the versatility of the Horizon computer to implement an interrupt driven bank-switching time sharing system. Requires additional memory & terminals.

$49.95

Micro Mike's

905 Buchanan, Amarillo, Texas 79101
806-372-3633

CIRCLE 166 ON READER SERVICE CARD

BASICP, modified NS BASIC to support password, NEWPASWD, basic program allows changing password, and, INSTRUCT, basic file containing easy to use instructions.

HSC Computer Services, Ltd., P.O. Box 43, Brooklyn, NY 11236.

CIRCLE 242 ON READER SERVICE CARD

NORTH STAR MODEM UTILITY

Telestar is an 8080 assembly language package for transferring named disk files thru the phone, via a modem, between two 8080 or Z-80 computers that utilize the North Star disk system; communicating with any remote timesharing system and saving all exchanged ASCII data to disk; and for retrieving that data from disk for later display or printout. The program will also allow a remote user to access and share the inputs and outputs of any program that uses the North Star DOS. The program was written for a North Star Horizon computer, but has a self-patch customizing routine for other types of I/O. $15.

Leonard E. Garcia, 3517 Herschel Ave., Dallas, TX 75219, (214) 522-1006.

CIRCLE 243 ON READER SERVICE CARD

TEXT OUTPUT PROCESSOR

J. Vilkaitis Consultants has developed an 8080 microcomputer based text output processing program that is compatible with the Script text processors. It handles form letters, document files, and mailing lists.

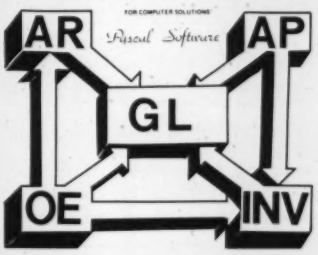
The Script - 80 system supports over 50 standard Script commands for the combining of multiple files, formatting and right justifying of text, margin and line length control, centering of title lines, spacing, immediate and conditional page eject, page headings, page footings, and several formats of page numbering. Text from up to 255 files may be nested and imbedded in the output text as though a part of the original file. Additional features include picture (pixel) processing, automatic multi-disk search for imbedded files, and extended upper/lower case conversion capabilities.

J. Vilkaitis, Consultants, Box 26, Thomaston, CT 06787, (203) 283-4232.

CIRCLE 244 ON READER SERVICE CARD

PASCAL BUSINESS SOFTWARE

P.S. Inc., has announced a system of Pascal business accounting packages. The software includes a general ledger package that permits a company to name and number over 1000 of its own accounts and to generate financial reports for the overall operation and for separate profit centers, if any. Accounts Payable, with aging and cash requirements reporting; Accounts receivable, with aging and sales analysis; Order Entry; and Inventory Control are tied into the general ledger. Thus, it is a "single entry" system. It is also "menu" oriented.



P.S. Inc., 619 NP Ave., Fargo, ND 58102, (701) 235-8145.

CIRCLE 245 ON READER SERVICE CARD

APPLE LOWER CASE

Appleshift is a package containing instructions for hardware modification of your APPLE keyboard, machine language subroutines for input and screen display, and an Integer Basic demonstration program called Textpage. Textpage allows you to enter, edit, store on disc, and print 55 lines of 80 characters. Disc Textpage requires a DOS system with at least 24K. Tape version needs 16K. $29.95.

C&H Micro, P.O. Box 2161, Glen Ellyn, IL 60137.

CIRCLE 246 ON READER SERVICE CARD

NEW **TRS-80 LEVEL II 16K** NEW

THE STOCK EXCHANGE

Real Time...only at THE STOCK EXCHANGE. Can you get involved in the minute-by-minute action...see the good news send stocks soaring...or the bad news send them down...buy/sell as it happens...feel the trader... THE STOCK EXCHANGE is one of the most fascinating and absorbing of simulations and a great educational investment.

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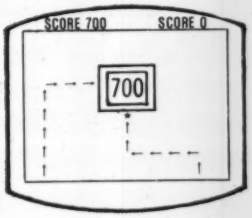

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WHEREAMI ?

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APPLICATION SOFTWARE

Talos Systems, Inc., has announced the development of application software for its DIGI-KIT-IZER graphic tablet. It includes seven programs written in Applesoft Basic. Programs included in this package are music generation by pen location, HIres graphics and LOres color graphics. $49.95.

Talos Systems, Inc., 7419 East Helm Dr., Scottsdale, AZ 85260, (602) 948-6540.

CIRCLE 247 ON READER SERVICE CARD

GENERAL LEDGER SYSTEM SOFTWARE

Percom Data Company has announced an accounting/bookkeeping software system for 6800 microcomputers. Called Percom General Ledger System, the programs run on computers using the company's LFD-400 dual-drive mini-disk storage device. It accommodates up to 250 accounts and uses 24K bytes of RAM. $199.95.

Percom Data Company, 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE 248 ON READER SERVICE CARD

TRS-80 TELCOM

A TRS-80 telecomunications package with full software control of RS-232 auto error retry which operates as a dumb terminal or intelligent terminal is available from Nash & Assoc. It allows the TRS-80 to collect programs or data from other TRS-80's or timeshare systems, run interactive programs between TRS-80's, utilize the BASIC and DOS commands under the intelligent terminal mode, save time-sharing data and reports on tape or disk, and, collect data in a distributive network environment from one or several businesses to a central TRS-80. $24.95

Charles R. Nash & Assoc., P.O. Box 856, Atlanta, GA 30301.

CIRCLE 249 ON READER SERVICE CARD

TRS-80 BOOKKEEPING

The Cash Journal Transaction Program, an addition to the General Ledger package, has been introduced by Taranto & Associates. In accepting entries directly from bank deposit slips or check stubs, the Cash Journal Program automatically posts the contracash amount as each item is entered.

If the General Ledger system is ordered at the same time or prior to the Accounts Payable, and Accounts Receivable systems, the General Ledger program will be supplied integrated to these systems. The systems are available at $99.95 each while the Cash Journal Program combined with the General Ledger is $149.95.

Taranto & Associates, P.O. Box 6073, San Rafael, CA 94903, (415) 472-1415.

CIRCLE 250 ON READER SERVICE CARD

TRS-80 DISK-BASED FORECASTING PACKAGE

Applied Economic Analysis announces the release of a Business Planning Package for the TRS-80. This disk-based package contains a set of forecasting programs for small businesses. Included in the package is an advanced version of multiple regression along with a seasonal adjustment program. The data preparation program allows the creation, modification and deletion of disk-based data sets. The data sets are accessible by all programs.

Applied Economic Analysis, 4005 Locust Avenue, Long Beach, CA 90807, (213) 424-3652.

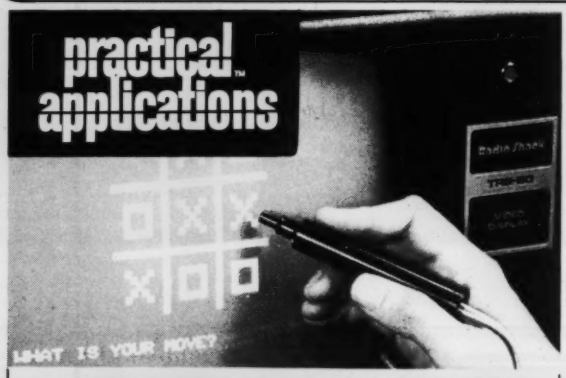
CIRCLE 251 ON READER SERVICE CARD

NEW TRS-80 SOFTWARE

The Software Association has announced a new line of entertainment programs for the TRS-80. All programs are written in machine language. They include: Z-Chess, a full featured chess opponent providing seven levels of difficulty, $17.95; Back-40, a backgammon challenger with a graphic board display, $14.95; and Dr. Chips, a program based on the "Doctor" and "Eliza" programs, $14.95. All programs require a 16K Level-II machine.

The Software Association, P.O. Box 58365, Houston, TX 77058.

CIRCLE 252 ON READER SERVICE CARD



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CIRCLE 176 ON READER SERVICE CARD

TRS-80

MEMORY EXPANSION KITS $79

Each Kit consists of: 8 Memory Chips, Jumper Blocks, and Complete EASY TO FOLLOW Instructions
Expands 4K TRS-80 up to 48K (3 sets)
TRS-80FLOPPY Disk (SA-400) Add On
COMPLETE Ready to use with power supply and case $389

ADD to your APPLE or $100 Bus Computer
$89 – Set of 8 250 NS
$99 – Set of 8 200 NS

No. 4116 – 200 NS (w/16K Chips), 16K, $279, 32K, $375, 48K, $469, 64K, 568

No. 4115, 8K, $189, 16K, $229, 24K, $269, 32K, $309

$100 Bus Expandoram Kits*

*Expand NOW or LATER to 64K (32K for *K Chips)
8K Chips: $49/Set of 8
ASSEMBLED, TESTED AND BURNED IN – ADD $50
MONEY BACK GUARANTEE
FULLY WARRANTED FOR 6 MONTHS
Master Charge – VISA – C.O.D. (25% with order) –
Money Order – California Residents add 6% Sales Tax
Shipping Charges: $2.00

MicroComputerWorld

P.O. Box 242 San Dimas, CA 91773
(213) 286-2661

CIRCLE 163 ON READER SERVICE CARD

TRS-80 BUSINESS PROGRAMS

Z Systems has developed a line of business related programs for the Radio Shack TRS-80 computer systems. Presently available on disk are: Payroll with complete department and sub-department reporting, Memominder, leave in $50; and, Order Tracker, a customer order inquiry system, $50. All programs come with complete, easy to understand, documentation and standard printer output control.

Z Systems, 144A Gen. Berry Dr., Bayside, NY, 11359.

CIRCLE 253 ON READER SERVICE CARD

COMPUTER BUGS SOFTWARE

The computer bugs have developed 3 software packages for the TRS-80 disk based system. They consist of: Text Editor, Rental Control System, and an Inventory Control System.

The Text Editor can transform your TRS-80 into a word processing machine. $29. The Rent Control System will provide a rent overdue report, a monthly rental report, monthly rental statements, reminder letters, occupancy status, and an alphabetic tenant list. $250. The inventory control system will handle up to 1200 parts on a single minidisk. $95.

The Computer Bugs, P.O. Box 789, Boynton Beach, FL 33435, (305) 734-2367/ 737-4738.

CIRCLE 254 ON READER SERVICE CARD

TRS-80 INCOME TAX PROGRAMS

For accountants and others involved in the preparation of income tax forms, Contract Services Associates has a line of professional software for TRS-80 32K disk and line printer systems. Form 1040 and related schedules are displayed on the video monitor while figures and other data are entered, computations are performed automatically, and then changes or additions can be made before printing out the form.

Contract Services Associates, 706 S. Euclid, Anaheim, CA 92802, (714) 635-4055.

CIRCLE 255 ON READER SERVICE CARD

MICRO LEARNINGWARE SOFTWARE

Micro Learningware offers educational programs in elementary mathematics, business, accounting, and economics. The programs include simulations, drill, practice, tutorial and game programs. The majority of the programs use graphics. They are written for the TRS-80, Level-II, and the PET. $2.95 — $5.95.

Micro Learningware, P.O. Box 2134, Mankato, MN 56001, (507) 387-1649.

CIRCLE 256 ON READER SERVICE CARD

T-BALL JOTTER DISK FOR TRS-80

Business Persons, accountants, loan officers, escrow officers, tax consultants, and other professionals will be interested in the T-Ball Jotter Disk from Contract Services Associates. The disk is for use with 32K TRS-80 disk and line printer systems. It contains a collection of business and professional programs which make many types of computations and print out forms used in the business and investment fields: amortization schedules, financial statements, and others.

Contract Services Associates, 706 S. Euclid, Anaheim, CA 92802, (714) 635-4055.

CIRCLE 257 ON READER SERVICE CARD

TRS-80 MAIL LIST

The Peripheral People have announced a new data base record keeping and mail list program. Mailroom Plus is a data base record management system for the TRS-80. It is useful in any application requiring the management of records having to do with people. It requires a minimum of 32K memory and one or more disk drives. $49.95.

The Peripheral People, Box 524, Mercer Island, WA 98040.

CIRCLE 258 ON READER SERVICE CARD

UNDER ATTACK!!!

Though the loose confederation of colonies in ORION had staved off the Stellar Union's bid for hegemony, would they do as well against the alien *Klottau*?

INVASION ORION

FOR TRS-80

INVASION ORION uses the simple, but unique and challenging STARFLEET ORION game system, but since your opponent isn't human, we've programmed the computer to play the *Klottau*. INVASION ORION is complete with program cassette, 64 page Battlemanual and control sheets. *10 all-new scenarios.* (Requires TRS-80, Level II, 16K).

Ask your local dealer or send $19.95 to:

Automated Simulations, Dept. C, P.O. Box 4232, Mountain View, CA. 94040.

California residents please add 6% sales tax.

CIRCLE 101 ON READER SERVICE CARD

APPLE II® PROFESSIONAL SOFTWARE

PIE (PROGRAMMA IMPROVED EDITOR) is a two-dimensional cursor-based editor designed specifically for use with memory-mapped and cursor-based CRT's. It is totally different from the usual line-based editors which were originally designed for Teletypes. The keys of the system input keyboard are assigned specific PIE Editor function commands. Some of the features included in the PIE system are: Blinking Cursor; Cursor movement up, down, right, left, plus tabs; Character insert and delete; String search forwards and backwards; Page scrolling; GOTO line number, plus top or bottom of file; Line insert and delete anywhere on screen; Move and copy (single and multiple lines); Append and clear to end of line; Efficient memory usage. The following commands are available in the PIE Text Editor and each is executed by depressing the systems argument key simultaneously with the command key desired.

[LEFT]	Move cursor one position to the left
[RGHT]	Move cursor one position to the right
[UP]	Move cursor up one line
[DOWN]	Move cursor down one line
[BHOM]	Home cursor in lower left left hand corner
[HOME]	Home cursor in upper left hand corner
[-PAG]	Move up (toward top of file) one "page"
[+PAG]	Move down (toward bottom of file) one "page"
[LTAB]	Move cursor left one horizontal tab
[RTAB]	Move cursor right one horizontal tab
[GOTO]	Go to top of file (line 1)
[ARG]n[GOTO]	Go to line 'n'
[BOT]	Go to bottom of file (last line + 1)
[-SCH]	Search backwards (up) into file for the next occurence of the string specified in the last search command
[ARG]t[-SCH]	Search backwards for string 't'
[+SCH]	Search forwards (down) into the file for the next occurence of the string specified in the last search command
[ARG]t[+SCH]	Search forward for string 't'
[APP]	Append -move cursor to last character of line +1
[INS]	Insert a blank line beforere the current line
[ARG]n[INS]	Insert 'n' blank lines before the current line
[DEL]	Delete the current line, saving it in the "push" buffer
[ARG]n[DEL]	Delete 'n' lines and save the first 20 in the "push" buffer
[DBLK]	Delete the current line as long as it is blank
[PUSH]	Save current line in "push" buffer
[ARG]n[PUSH]	Save 'n' lines in the "push" buffer
[POP]	Copy the contents of the "push" buffer before the current line
[CINS]	Enable character insert mode
[CINS][CINS]	Turn off character insert mode
[BS]	Backspace
[GOB]	Gobble - delete the current character and pull remainder of characters to right of cursor left one position
[EXIT]	Scroll all text off the screen and exit the editor
[ARG][HOME]	Home Line - scroll up to move current line to top of screen
[APP][APP]	Left justify cursor on current line
[ARG][GOB]	Clear to end of line

PROGRAMMA Software Products

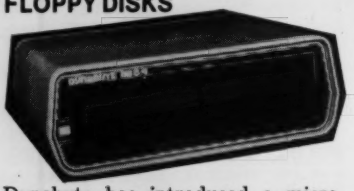
Apple Pie Cassette	16K	$19.95
TRS-80PIE Cassette	16K	19.95
Apple PIE Disk	32K	24.95

PROGRAMMA INTERNATIONAL, Inc.
3400 Wilshire Blvd.
(213) 384-0579 / 384-1116 / 384-1117 Los Angeles, CA 90010

CIRCLE 178 ON READER SERVICE CARD

COMPUTERS

DOUBLE DENSITY FOR 8" FLOPPY DISKS



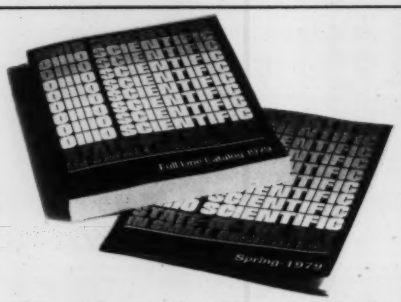
Dynabyte has introduced a microcomputer system using its disk controller that offers up to 512 kbytes of floppy disk storage on each of 2 Shugart single-sided drives or 2 megabytes on 2 double-sided drives. It is a disk controller capable of handling a variety of 5-inch and 8-inch drives in dual density on either one or two sides. To permit expansion of the system as the user's needs increase, the controller is capable of handling up to 16 drives.

Dynabyte Inc., 1005 Elwell Court, Palo Alto, CA 94303, (415) 965-1010.

CIRCLE 259 ON READER SERVICE CARD

FULL LINE CATALOG

Ohio Scientific, Inc., has announced the publication of their new 1979 Full Line Catalog. Edited to tell "Everything you've always wanted to know about personal and small business computers,"



this catalog and buyer's guide is published in a two-part set with the 310-page paperback handbook supported by a 16-page Price List supplement.

This publication covers the wide range of personal and small business computer applications, including capability of upgrading the system(s) for future expansion. $1.00.

Ohio Scientific, Publications Dept., 1333 S. Chillicothe Rd., Aurora, Ohio 44202. Allow two weeks for delivery.

CIRLCE 260 ON READER SERVICE CARD

PORTABLE COMPUTER

GM Research has introduced a portable computer in a single enclosure. It has the following features: 8 slot S-100 bus card cage, 14 AMP power supply, high resolution 9" ball brothers CRT display, integral implosion protective shield, 77-key keyboard with numeric pad and cursor control keys, detachable key board, retractable carrying handle, optional carrying cover, space for one 5" mini disc drive with mounting hardware for Micropolis or Wangco, space for three I/O connectors on rear panel, rear panel reset and power switches, and a 5" fan. It measures 20¼" x 8" x 16"; and requires 115 V 50/60 HZ 300 watts max.

GM Research, 1048 East Burgrove St., Carson, CA 90746, (213) 639-4663.

CIRCLE 261 ON READER SERVICE CARD

ONYX MICROCOMPUTER SYSTEM

Onyx Systems, Inc. has introduced a Z80-based microcomputer system with an 8-inch, Winchester-type rigid disk drive. Called the C8000, it incorporates a 4 MHz Zilog Z80A CPU, a 10-megabyte rigid disk, and a 12-megabyte cartridge tape drive, in a compact tabletop package. The rigid disk has an average access time of 50 ms, and can be completely backed up with a single cartridge on the tape drive in 20 minutes. $12,500.

Onyx Systems, Inc., 10375 Bandley Dr., Cupertino, CA 95014, (408) 257-8022.

CIRCLE 262 ON READER SERVICE CARD

NEW!

Apple software from RAINBOW

PIE TEXT EDITOR Machine language, cursor-based text editor for 16K Apple.
- Features format capabilities of most text editors.
- All commands are control characters.
- Enables you to define your own function commands.

Order PIE on cassette: $19.95. . . . . .on diskette $24.95

HIGH RESOLUTION CHARACTER GENERATOR Machine language program for 16K Apple.
- Define your own character set and graphic shapes.
- Complete English upper/lower case character set.
- Complete Greek Alphabet with upper/lower character set.
- Scroll, vary window size, invert characters, switch back and forth between two character sets.

Order on cassette $19.95. . . . . .on diskette $24.95

FORTE Music Interpreter in Machine Language for 16K Apple.
- Handles six voices.
- Single step capability.
- Full editing features.
- Trace line numbers or notes.
- Save songs on cassette or diskette.

Order FORTE on Cassette. $19.95

APPLE Monitor PEELED Everything you wanted to know about the Apple Monitor but couldn't figure out. User-written manual in plain English clears your confusion. **$9.95**

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CIRCLE 140 ON READER SERVICE CARD

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THE BIG Z
THE NEW Z-80
CPU BOARD FROM JADE

Features Include: ■ S-100 Compatible, available in 2MHz or 4MHz versions. ■ On-board 2708, 2716, 2516, or 2532 EPROM can be addressed on any 1K, 2K, or 4K boundary, with power-on jump to EPROM. ■ On-board EPROM may be used in SHADOW mode, allowing full 64K RAM to be used. ■ Automatic MWRITE generation if front panel is not used. ■ On-board USART for synchronous or asynchronous RS232 operation (on-board baud rate generator). ■ Reverse-channel capability on USART allows use with buffered peripherals or devices with "not-ready" signal.

2MHz-	Kit: CPU-30200K, 2 lbs	$149.95
	Assembled and Tested: CPU-30200A, 2 lbs	$199.95
4 MHz-	Kit: CPU-30201K, 2 lbs	$159.95
	Assembled and Tested CPU-30201A, 2 lbs	$209.95

JADE'S DOUBLE DENSITY

DD™

KIT: $249.00
Assmb. & Tstd: $299.00

- Single or Double Density Recording
- Full Size or Mini Floppy
- CP/M Compatible in either density
- Programmed Data Transfer, no DMA
- Controls up to 8 drives
- IBM format in either density
- Software Selectable Density

■ This controler utilizes the proven reliability of the IBM standard format as well as the lastest phase-locked-loop for data separation ■ All clocks are generated from an on-board crystal oscillator ■ Right precompensation is used to enhance data recovery reliability in the double density mode ■ Density selection is entirely transparent to the user ■ Single and double density diskettes can be mixed on the same system.

MICROPROCESSORS

F8	$16.95
Z80 (2MHz)	$10.95
Z80A (4MHz)	$14.95
CDP1802CD	$19.95
6502	$11.95
6800	$9.75
6802	$14.00
8008-1	$15.95
8035	$24.00
8035-8	$24.00
8080-A	$10.00
8085	$23.00
TMS9900TL	$49.95

8080A SUPPORT DEVICES

8212	$2.90
8214	$4.65
8216	$2.75
8224 (2MHz)	$4.30
8224-4 (4MHz)	$9.95
8226	$2.75
8228	$6.40
8238	$6.40
8243	$8.00
8251	$7.50
8253	$20.00
8255	$6.40
8257	$18.00
8259	$18.00
8275	$51.20
8279	$17.70

USRT

S2350	$10.95

UARTS

AY5-1013A	$5.25
AY5-1014A	$8.25
TR1602B	$5.25
TMS6011	$5.95
IM6403	$9.00

BAUD RATE GENERATORS

MC14411	$10.00
14411 Crystal	$4.95

6800 PRODUCT

6821P	$5.25
6828P	$9.50
6834P	$16.95
6850P	$4.80
6852P	$5.25
6860P	$9.25
6862P	$12.00
6875L	$7.30
6880P	$2.50

CHARACTER GENERATORS

2513 Upper (1-12+5)	$6.75
2513 Lower (1-12+5)	$6.75
2513 Upper (5 volt)	$9.75
2513 Lower (5 volt)	$10.95
MCM6571 up scan	$10.95
MCM6571A down scan	$10.95

PROMS

1702A	$5.00
2708	$12.95
2716 (5+12)	$49.00
2716 (5v)	$49.00
2758 (5v)	$30.00

DYNAMIC RAMS

416D/4116 (200ns)	$12.50
2104/4096	$4.00
2107B-4	$3.95
TMS4027/4096	$4.00

STATIC RAMS	1—15	16—100
21L02 (450ns)	$1.50	$1.20
21L02 (250ns)	$1.75	$1.50
2101-1	$2.95	$2.60
2111-1	$3.25	$3.00
2112-1	$2.95	$2.65

FLOPPY DISK CONTROLLERS

1771801	$39.95
1791	$49.95

KEYBOARD CHIPS

AY5-2376	$13.75
AY5-3600	$13.75
MM5740	$18.00

POWER SUPPLIES

PSD-249A: For a Single 5 1/4" Disk Drive. By Power-One or Alpha Power: +/- 5V at .7A, +/- 12V at 1.1A $52.00

PSD-205A: For Single 8" Disk Drive. By Power-One. +5V at 1A, -5V at .5A, +24V at 1.5A $89.95

PSD-206A: For Two 8" Disk Drives. By Power-One or Alpha Power. +5V at 2.5A, -5V at .5A, +/-24V at 3A $125.00

Rockwell: Aim-65 Power Supply PSX-030A $59.95

KIM-1 or SYM-1 Power Supply: PSX-020A $59.95

★ DISK DRIVES ★

B51 5¼" $295.00
by Micro Peripherals, Inc. Operates in either single density (125KB, unformatted) or double density (250KB, unformatted) modes, up to 40 tracks, with a track-to-track access time of only 5 ms.

SA801R $575.00
by Shugart Single-sided 8" floppy disk drive.

FD8-100 $395.00
GSI/Siemens. Runs cooler and quieter than 801 (8")

SA400 $325.00
Single density 5¼, 35-Track drive. Cabinet and power supply available

1791 BO1
Dual Density Controller Chip
$49.95

Vista V80 Mini Disk SYSTEM FOR TRS—80
$395.00

Includes disk drive, power supply, regulator board, and compact case. The V-80 offers 23% more storage capacity. Simply take it out of the box, plug in the cable, and it's ready to run. Requires 16K, Level II, expansion interface.

Signal Cable $24.95

JADE CABLE ASSEMBLIES

Mini-Disk Cable Kit: 5 1/4" interface to 2 Shugart or compatible drives. Cable is 5' long with 34 pin edge connectors WCA-3431K $34.95

8" Disk Cable Kit No. 1: 34 pin assembly WCA-5031K $38.45

8" Disk Cable Kit No. 2: 50 pin assembly (great for Tarbell disk controller) WCA-5032K $38.45

Signal Cables: 6 feet long, 34 pin edge connectors at each end $24.95
WCA-3421A

JADE ISO—BUS MOTHERBOARDS

Comes in either 6, 12, or 18 slot sizes. These boards with a special ground plane assures a silent operation

JADE 6 Slot	
Kit	$49.95
Assembled	$59.95
Bare Board	$24.95
JADE 12 Slot	
Kit	$89.95
Assembled	$99.95
Bare Board	$39.95
JADE 18 Slot	
Kit	$129.95
Assembled	$149.95
Bare Board	$59.95

- Two Drives Siemens/ GSI 8" Floppy
- Power Supply for Above
- Jade Double Density Board (KIT)
- CP/M Operating System with Basic E
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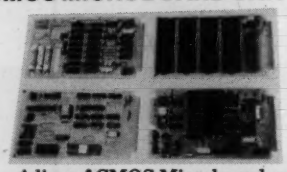
CIRCLE 107 ON READER SERVICE CARD

CMOS MICROBOARD UNITS



A line of CMOS Microboard computer units has been announced by RCA Solid State Division. The Microboard circuits include three "Computer-on-a-board" systems, four memories, five expansion modules, 4.5x7.5 inch printed circuit boards, plus a power converter and three chassis.

The three "computer-on-a-board" Microboard units are complete computer systems each containing an 1802 COSMAC microprocessor, a crystal-controlled clock, read-write memory, parallel I/O ports, a serial communication interface, power-on reset, an expansion interface, and sockets for user-selected read-only memory. Prices with 1K RAM start at $475.

RCA Solid State Division, Box 3200, Somerville, NJ 08876, (201) 685-6599.

CIRCLE 263 ON READER SERVICE CARD

MIDAS

MIDAS provides the user with a high level language capability and relational data base. Using these capabilities, a multiterminal application can be programmed in a shorter time. It runs on a 10 and 20 megabyte MITS 300/55 system with either the Lear Siegler ADM-2A, LSI-42 or the Soroc 140 terminal. In addition TCSS has an S-100 9-track magnetic tape interface to permit the user to transfer data between the micro and any other computer with tape facility. MIDAS is available as a complete hardware/software system, or separately as the operating system software only. The cost of the hardware/software system is $25,000; which includes a 64K S-100 bus microcomputer, rack mounted with a 10 megabyte hard disk subsystem; 3 serial ports, two SOROC 140 terminals and a Centronics matrix printer. The cost of MIDAS alone is $2200.00. This includes a disk pack, the SX-100 security board and an operators reference manual.

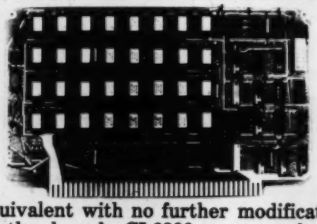
The Computer Systems Store, 14 Ridgedale Ave., Cedar Knolls, NJ 07927, (201) 538-0646.

CIRCLE 264 ON READER SERVICE CARD

MEMORY

64K BYTE RAM MEMORY BOARD

Designed specifically for operation with Motorola EXORcisor, Motorola Exorcisor II and MEC 6800 evaluation modules is Chrislin Industries CI-6800 16K x 8 semiconductor memory system. It features easy expansion to 32K, 48K or 64K by simply interchanging the 4027, 4K by 1 dynamic memory chip with it's 16K

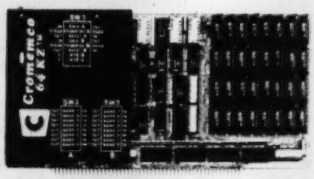


equivalent with no further modification to the board. CI-6800 memory board plugs directly into existing EXORcisor Connectors. Single quantity pricing $390.00 for 16K x 8 and $750.00 for 64K x 8. Delivery is stock.

Chrislin Industries, Inc., Computer Products Division, 31352 Via Colinas, #102, Westlake Village, CA 91361, (213) 991-2254.

CIRCLE 265 ON READER SERVICE CARD

64KZ RAM CARD



The Cromemco 64KZ is an S-100 bus compatible 65,536 byte read/write memory board. The 64KZ incorporates 16K RAM chips with 150 nsec access times. So it can reliably operate in 4MHz

FOR PET, TRS 80, COMPUCOLOR.

SOUNDWARE adds music and sound effects to your computer. Includes DEMO PROGRAM, SOUND COMPOSER (to create your own BASIC sound subroutines) and instructions. Unit has volume control, earphone jack, connectors. 1 year warranty. $29.95 for PET & TRS-80 Level II. $39.95 For Compucolor II (includes Diskette).

SOUNDWARE SOFTWARE FOR 8K PET!

Compatible with all CB-2 sound devices. Features sound, super graphics, instruction booklet. 90 day warranty.

1. ACTION PACK—Breakthru (8 versions) / Target / Caterpillar
2. THE CLASSICS—Checkers (8 versions) / Backgammon / Piano Player
3. WORD FUN—Speller (4 versions) / Scramble / Flashcard

$9.95 per pack. More sound programs coming: TRS-80 and Compucolor, too!

To Order: Send to CAP Electronics, Dept. CR , 1884 Shulman Ave., San Jose, CA 95124, or call (408) 371-4120. VISA / Master Charge accepted. No charge for shipping when payment is included. Please add 15% for C.O.D. Calif. residents add 6% tax.

Prices subject to change without notice.

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CIRCLE 134 ON READER SERVICE CARD

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Compucolor II

NEW! from Eventide AUDIO SPECTRUM ANALYZER $595

NEW! PET BUSINESS SYSTEM

PET 2001 - 16K $995 32K $1295

MARK SENSE CARD READER $750

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SUPER SOFTWARE

PET PRINTERS • 2023 $849 2022 $995 (includes Tractors)

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SPECIAL 12" Video Monitor for SORCERER ($299 value) ONLY $125 with 8K unit 95 with 16K unit 65 with 32K unit

ANDERSON JACOBSON

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DUAL DRIVE FLOPPY DISK 2040 $1295

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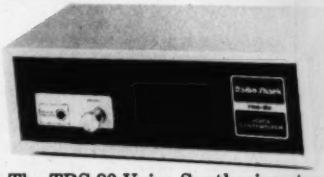
Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043, (415) 964-7400.

CIRCLE 266 ON READER SERVICE CARD

PERIPHERALS

TRS-80 VOICE SYNTHESIZER



The TRS-80 Voice Synthesizer translates the computers' output into recognizable, intelligible speech. The synthesizer includes a volume control, built-in speaker and cable assembly. This will also enable the computer to speak in foreign languages or with an accent by integrating the various phonemes to produce the desired sounds. $399.

Radio Shack, 1300 One Tandy Center, Fort Worth, TX 76102, (817) 390-3272.

CIRCLE 268 ON READER SERVICE CARD

TRS-80 INPUT/OUTPUT INTERFACE

JC Enterprises, has announced the A828 AC-P/TRS-80 Input/Output Interface, designed to expand the TRS-80

capability by providing 4 channels of programmable AC power control, 600W each channel, 1600W total. The A828/TRS-80 combination can be used to sense switch closures, photosensors, and 5V logic levels, drive LED displays, operate motors, solenoids, alarms, etc. $165.

JC Enterprises, P.O. Box 23445, San Diego, CA 92123, (714) 277-6585.

CIRCLE 269 ON READER SERVICE CARD

LIGHT PEN FOR TRS-80

A self-contained light pen which plugs directly into the Radio Shack TRS-80 bus connector has been announced by the 3G Company. The light pen makes it possible to bypass the TRS-80's keyboard and interact directly with the information displayed on the CRT screen. The light pen adds versatility to most graphics programs and makes possible unique games. $34.95 plus $1.50 postage (Foreign, $6.00).

3G Company, Inc., Rt. 3, Box 28a, Gaston, OR 97119, (503) 662-4492.

CIRCLE 270 ON READER SERVICE CARD

INTERFACE BOARD

Garry Manufacturing Co. has introduced Camac interface boards for integrated circuit pluggable wire wrap applications. They provide 38 universal rows of 64 socket terminals per row with ground and voltage terminals between every other row. The boards will accommodate up to 125 16 pin integrated circuits or an equivalent mix of larger integrated circuits. $2 — $3 per integrated circuit position.

Garry Manufacturing Co., 1010 Jersey Ave., New Brunswick, NJ 08902.

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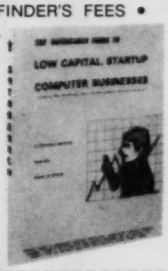

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LIGHT PEN FOR PET

A self-contained light pen which plugs directly into the Commodore PET 2001 user port has been announced by the 3G company. The light pen makes it possible to bypass the PET's keyboard and interact directly with the information displayed on the CRT screen. The light pen adds versatility to most graphics programs and makes possible unique games. It sells for $29.95 (plus $1.50 for postage, $6.00 Foreign).

3G Company Inc., Rt. 3, Box 28a, Gaston, OR 97119, (503) 662-4492.

CIRCLE 272 ON READER SERVICE CARD

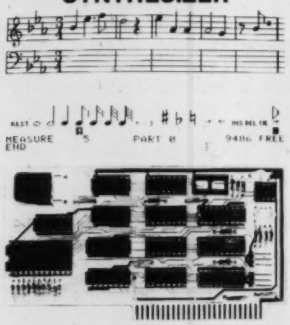
APPLE II LIGHT PEN

Symtec Inc. has announced a light pen for the Apple II. Software support is available in machine code, applesoft, and interger basic. The Symtec Light Pen reads the CRT raster directly and requires a small amount of memory so that the maximum space is left for the user. $249.95.

Symtec Inc., P.O. Box 462, Farmington, MI 48024.

CIRCLE 273 ON READER SERVICE CARD

ALF'S APPLE MUSIC SYNTHESIZER

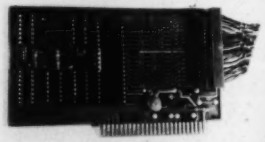


A complete music synthesizer which plugs into your Apple II computer and your home stereo system, designed for use in a wide range of applications for both musicians and recreational use is available from ALF Products, Inc. The synthesizer features three independent voices (6 or 9 voices using 2 or 3 units), an eight octave range which includes the full piano range, 24 or more notes per octave, accurate (crystal-controlled) tuning, and volume/envelope control. Five sample songs are included on the software cassette. $265.

ALF Products Inc., 128 South Taft, Denver, CO 80228, (303) 234-0871.

CIRCLE 274 ON READER SERVICE CARD

APPLE ANALOG INPUT CARD



The AI-02 Analog Input Card by Interactive Structures, Inc., provides a single card data acquisition system for Apple-II computers. Sixteen analog channels may be monitored by the system with 8-bit resolution. Channels are individually addressable and conversion time is 70 microseconds. The system can be operated easily from BASIC, and also provides interrupt capability.

Interactive Structures, Inc., Suite 204, 3401 Science Center, Philadelphia, PA 19104.

CIRCLE 275 ON READER SERVICE CARD

DS-80 DIGISECTOR

The Micro Works Digisector is a random access video digitizer. The board provides the following features: high resolution, precision, speed, versatility,

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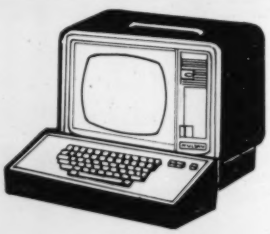

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The Micro Works, P.O. Box 1110, Del Mar, CA 92014, (714) 756-2687.

CIRCLE 276 ON READER SERVICE CARD

HI PAD DIGITIZER BROCHURE

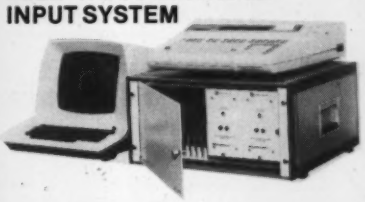
An eight page brochure describing the HI PAD Digitizer is available from Houston Instrument. The digitizer offers user controllable features such as metric/inch capability, binary/BCD outputs, RS—232C/8—bit parallel interface, all selectable at the interface connector.

The new brochure includes prices and specifications for the HI PAD and accessories as well as complete technical descriptions of the multiple output formats available with the HI PAD.

Houston Instrument, One Houston Square, Austin, TX 78753, (512) 837-2820.

CIRCLE 277 ON READER SERVICE CARD

I EEE-488 COMPATIBLE INPUT SYSTEM



Cyber Systems, Inc. has announced the CYBER I Measurement and Control System. It is IEEE-488 compatible and has been designed to interface with most desk top calculators. Several outstanding user benefits of the CYBER I are: analog-to-digital isolation via an optical transceiver to minimize noise interference and to provide high common mode immunity; a programmable reference supply with NBS traceability is provided; integral signal conditioning with standard six wire configuration and R-CAL; acquisition expansion to 2000 channels; provides automatic bridge balancing; and integral discrete I/O and DAC output for process control.

Cyber Systems, Inc., 5082 Shirley Dr., La Palma, CA 90623, (714) 523-2015.

CIRCLE 278 ON READER SERVICE CARD

FLOPPY DISC AND TAPE STORAGE

RS232 MINI FLOPPY TERMINAL

A RS232 compatible minifloppy disk storage and edit terminal is available from Western Telematic, Inc. Designated MiniMate, the unit is designed as an attachment to intelligent CRT or hard copy terminals to handle, store and forward applications effectively and efficiently. It also includes character edit capability. The MiniMate provides over

71,000 characters of working storage. It is capable of communicating with a host computer in either batch or interactive mode at speeds up to 9600 baud. $1295.

Western Telematic Inc., 2435 S. Anne St., Santa Ana, CA 92704, (714) 979-0363.

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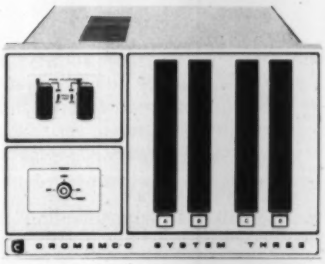

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CIRCLE 147 ON READER SERVICE CARD

GUNN UTILITY DISK

Cromemco owners can handle disk directories and files easier and faster with the 11 utilities on the Gunn Utility Disk No. 1. This new machine language utility package is used with CDOS. The new Gunn utilities will perform the following tasks: alphabetize diskette directories; create .CMD files from directory to allow transferring or outputting selected file groups to any device desired, such as punch, printer, or other drives; isolate bad diskette clusters into bad-cluster directory entries to keep them from interfering with diskette space allocation beyond the bad area; recover/display erased directory entries; map on console or printer the diskette clusters occupied by all or any selected file or group of files; permit jumping to and executing programs at a hex address; provide current date (month, day of month, year) for easy use by any program with file access capability; automatically eject diskette from selected drive(s) when desired; cold boot from diskette in drive A; output preselected number of form feeds to the printer; set Diablo 1620/Qume Sprint 5 printer margin and paper movement parameters from the console; and, suspend system operation at selected program points to allow positioning cut paper in printer. $95.

Comput-R-Ware, Div. Ken Kirkpatrick Advertising Inc., 7910 Westglen, Houston, TX 77063.

CIRCLE 280 ON READER SERVICE CARD

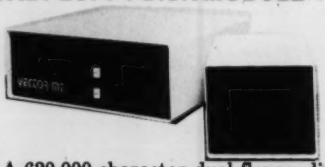
NORTH STAR QUAD DISK SYSTEM

North Star Computers has announced the availability of quadruple capacity mini-disk drives for their Horizon computer. This increases the Horizon's information storage capability to 360,000 bytes per 5-¼" floppy disk. The quadruple capacity is also available on North Star's Micro Disk Systems.

North Star Computers, 2547 Ninth St., Berkeley, CA 94710 (415) 549-0858.

CIRCLE 281 ON READER SERVICE CARD

DUAL FLOPPY DISK MODULE

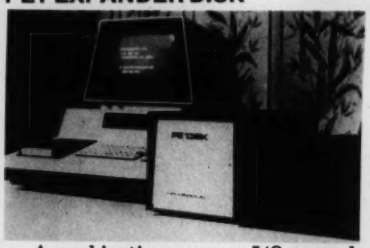


A 630,000 character dual floppy disk module has been announced by Vector Graphic Inc. Called Micro-Stor, this unit is used to expand Vector Graphic MZ and Memorite II systems from two disk drives to four, allowing implementation of business and scientific software requiring this increased storage capacity. $1395.

Vector Graphic, Inc., 31364 Via Colinas, Westlake Village, CA 91361, (213) 991-2302.

CIRCLE 282 ON READER SERVICE CARD

PET EXPANDER DISK



A combination memory-I/O expander and floppy disk system for the PET Computer by Commodore is available. The Pedisk provides both a high speed floppy disk and an S100 expansion chassis. The S100 expansion will hold all the extra I/O and memory a PET user could want: printer, telephone interface, modem, and even voice I/O cards. $799.95.

CGRS Microtech, P.O. Box 368, Southampton, PA 18966.

CIRCLE 283 ON READER SERVICE CARD

DM-85 DISK MIXER

The DM-85 Disk Mixer is an add-on board for the Smoke Signal Broadcasting BFD-68A Disk Controller which allows operation of both 8" and 5" drives. Controller mode (8" or 5") is selected on a drive-by-drive basis, so any mix of 5" and 8" drives is allowable. The 2x3" PC board mounts on the back of the BFD-68A. An

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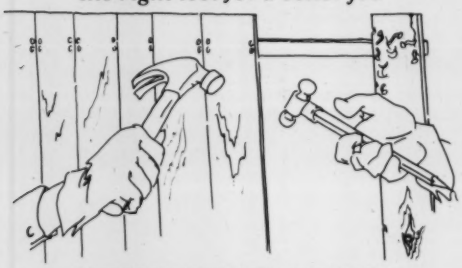

For more information, contact distributors below or visit your local software dealer (and take along this ad). Dealer inquiries invited.

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ALPHA MICRO AM-100	218	The Computer Workshop of No. VA., Inc. Ravenswood Shopping Center 5240 Port Royal Rd., Springfield, VA 22151 Tel. [703] 321-9047
INTEL MDS/SER 2	219	Tau Sigma Consultants, Inc. 6420 Flying Cloud Dr., Eden Prairie, MN 55344 Tel. [612] 944-7354
CROMEMCO	220	DGA Enterprises, Inc., c/o BYTE SHOP 6341 Albemarle Rd., Charlotte, NC 28212 Tel. [704] 568-8100
TRS-80 TECHNICO	221	Radio Ranch, Inc. Radio Ranch Airport — Rt. 3, Polo, IL 61064 Tel. [815] 946-2371
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Tarbell BASIC occupies 24K of RAM. Tarbell BASIC on CP/M* Disk $48. Source on paper or CP/M Disk $25.

*CP/M is a Trademark/Tradename of Digital Research.

Tarbell Electronics
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CARSON, CA 90746
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CIRCLE 189 ON READER SERVICE CARD

oscilloscope is required for the setup procedure. $39.95. The Micro Works, P.O. Box 110, Del Mar, CA 92014, (714) 756-2687.

CIRCLE 284 ON READER SERVICE CARD

ADD-ON MINI-DISK SYSTEMS

Percom Data Company has announced the expansion of "add-on" mini-disk data storage systems for the Radio Shack TRS-80 microcomputer to include both 40- and 77-track drives. Prices range from $399 to $2025.

Percom Data Company, 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE 285 ON READER SERVICE CARD

PEDISK SYSTEM

The CGRS PEDISK system comes in several versions: package 1 is a SA 400 type disk drive with no memory expansion to the S-100 bus; package 2 adds the S-100 adaptor parts; package 3 has a 10 slot motherboard; package 4 has a 5 lot motherboard, CGRS power supply, the CGRS PEDISK system and the disk controller and disk drive. $150-$300.

CGRS Microtech, P.O. Box 368, Southampton, PA 18966.

CIRCLE 286 ON READER SERVICE CARD

TERMINALS

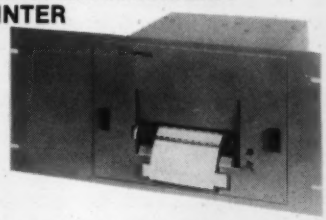
TERMINAL RENTALS

Electro Rent has expanded into the terminal rental business. The company's inventory consists of DEC, IBM, Hazeltine, Lear Siegler, Centronics, TI, TTY, Anderson-Jacobson and Novation equipment.

Electro Rent, 4131 Vanowen Place, Burbank, CA 91505, (800) 423-2337, (800) 232-2173 (in CA).

CIRCLE 287 ON READER SERVICE CARD

SP-310 ALPHANUMERIC PRINTER



Syntest Corporation has announced a rack mounted model SP-310 alphanumeric 5x7 dot matrix impact printer. This new unit provides 40 column printing at 50 characters per second. Microprocessor control allows special functions such as tab and double width printing. RS-232 and 20 mA inputs are provided as standard. A triple line input buffer is optional. $605.

Syntest, 169 Millham St., Marlboro, MA 01752, (617) 481-7827.

CIRCLE 289 ON READER SERVICE CARD

QUIET 300 FORMS ACCESS PRINTER

Local Data has announced the Quiet 300 Forms Access Printer. This full-character unit features a Teletype model 40 print mechanism. It features a Buffered-Serial interface with a 1 to 4K memory with X-ON, X-OFF option. And, it is Centronics or Dataproducts parallel plug compatible. It's a compact unit, measuring 21" x 18" x 40" and weighing only 140 pounds. $3910.

Local Data Inc., 2701 Toledo St., Suite 706, Torrance, CA 90503, (213) 320-7126.

CIRCLE 290 ON READER SERVICE CARD

DEC VT-52 EMULATION

Intertec Data has upgraded its InterTube II Video Terminal to offer compatibility with the VT-52 Video Terminal manufactured by Digital Equipment Corporation. The InterTube offers other standard features including: an upper and lower case character set displayed on an 8 x 10 dot matrix; a full 25 line by 80 character screen; a full ASCII keyboard with an 18 key numeric pad; 14 user-defined function keys; typamatic repeat of all keyboard keys; individual backspace and shift lock keys; cursor control keys; full cursor addressing and a

THE PERFECT COMBINATION

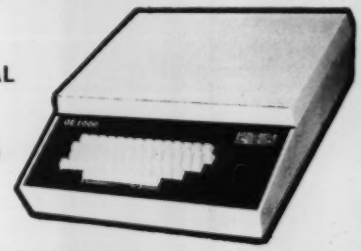
$139.00

VIDEO 100 MONITOR

The Video 100 is designed to meet your monitor needs for both personal and business use. It is compatible with a wide range of computer systems, and with a bandwidth of 12 MHz it is capable of displaying up to 80 characters per line on this 12" B/W CRT. The solid state circuitry assures a stable & sharp display. The front panel controls include power, contrast, horizontal and vertical holds. Adjustments for height, vertical linearity, and width control are located on a rear panel. All the above features for only $139.00.

OE 1000 VIDEO TERMINAL

$275.00



The OE 1000 Video Terminal provides you with a low cost means to communicate with your computer. The OE 1000 will display 16 lines of 64 characters on a monitor or modified TV. The terminal will generate and display the full 96 ASCII character set (upper and lower case) plus 32 special characters (Greek letters and math symbols). The terminal will also erase to end of line, erase to end of screen, scroll, and it has full X-Y cursor movement. Interfacing to your computer requires a full duplex, serial, RS232 or 20 mA loop I/O port at the rate of 110 or 300 baud. The OE 1000 sells for $350 assembled or $275 in kit form.

Master Charge, Visa, accepted. COD Extra. Add $5 per unit, $10 both units, shipping handling insurance.

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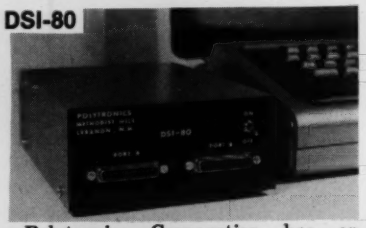
CIRCLE 172 ON READER SERVICE CARD

graphics mode to facilitate easy design and display of all types of forms. $100.

Intertec Data Systems Corporation, 2300 Broad River Road, Columbia, SC, (803) 798-9100.

CIRCLE 291 ON READER SERVICE CARD

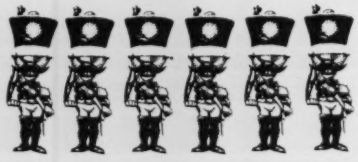
DSI-80



Polytronics Corporation has announced the DSI-80, a dual serial interface for use with the Radio Shack TRS-80 microcomputer. The DSI-80 provides two serial output ports with current loop, RS-232 interfaces, and speed selections of 110, 150, 300, 600 and 1200 baud are accomplished by jumpers. $199.95.

Polytronics Corporation, Methodist Hill, Lebanon, NH 03766, (603) 448-1710.

CIRCLE 292 ON READER SERVICE CARD



MISCELLANEOUS

CRT SCREEN SPRAY

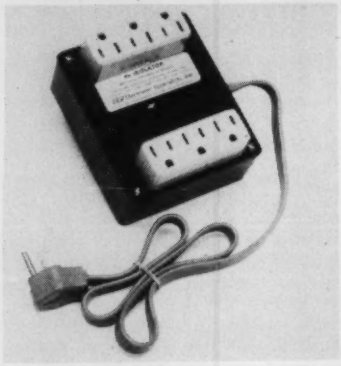
CRT Screen Spray removes dust, smoke particles, fingerprints and other vision-hindering contaminants from the surface of CRT terminal screens. $3.00.

American Word Processing Company, 18730 Oxnard St., Tarzana, CA 91356, (213) 705-2245.

CIRCLE 293 ON READER SERVICE CARD

AC SOCKETS

Electronic Specialists has expanded its Isolator line with Model ISO-2. It is comprised of two filtered banks of 3-prong AC sockets with integral surge suppression. Each socket bank is filter isolated from the other bank and from the AC power line. $49.95.



Electronic Specialists, Inc., Box 122, Natick, MA 01760, (617) 655-1532.

CIRCLE 294 ON READER SERVICE CARD

BLITZ BUG

The Blitz Bug offers a solution for protecting solid state transistorized electronic devices such as radios, televisions, electronic clocks, computers, microwave ovens, etc.

The Blitz Bug is a lightening and transient suppressor operating in a similar manner as a variable resistor. When exposed to potentially dangerous electrical voltages the Blitz Bug changes from a high resistance state to a low one in less than 50 nanoseconds.

Omni Communication Company, Inc., 200 West County Line Rd., Jackson, NJ 08527.

CIRCLE 295 ON READER SERVICE CARD

DATA DUBBER

Problems CLOADing program tapes are virtually eliminated with a new product called the "Data Dubber." Recordings that have waveform distortion, noise, hum and even minor dropouts can be regenerated by the "Data Dubber" to produce data pulses identical with the TRS-80 CSAVE data stream. These idealized pulses can either CLOAD the TRS-80 or feed a second recorder for

TORA SYSTEMS INC.

TRS-80 T58

TRS-80 is a product of Radio Shack. A Tandy Corporation

Level II-4K	$626.00
Level II-16K (w/o num. keypad)	$799.00
Expansion Interface Ø	$269.00
Expansion Interface 16K	$423.00
Expansion Interface 32K	$592.00
16K Memory Expansion Kit (with Jumpers and inst)	$ 89.95

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ADD-ON

SA-400 SHUGART DISK DRIVE FOR TRS-80 Includes power supply and custom walnut formica enclosure (see below)	$ 415.00
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HORIZON I KIT	$1039.00
CENTRONICS 799 PRINTER-TRACTOR (TRS-80)	$1099.00
ENCLOSURE FOR SHUGART SA-400 WALNUT FORMICA CUSTOM DESIGN	$ 27.95
ENCLOSURE FOR DUAL SHUGART SA-400	$ 39.95
RIBBONS FOR MOST PRINTERS	INQUIRE

INTERTUBE TERMINAL
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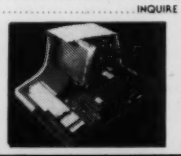

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CIRCLE 122 ON READER SERVICE CARD

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Programmer's Guides for the PET™

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Covers the fundamentals of PET BASIC: calculator and program mode, data input and output, data representation, program storage on the cassette.

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PET Graphics WB-3 $4.95
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PET Cassette I/O WB-4 $4.95
Covers OPEN, CLOSE, string and numeric data files.

Miscellaneous PET Features WB-5 $3.95
Covers the clock, random number generator, upper and lowercase alphabetic characters, saving memory space, etc.

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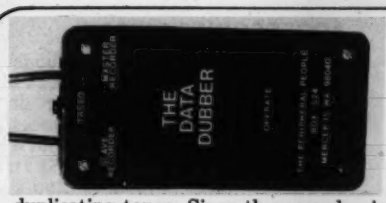
CIRCLE 190 ON READER SERVICE CARD



duplicating tapes. Since the recorder is simply copying pulses, data and machine language tapes can be reproduced as easily as those in basic. The regeneration technique employed works equally well on Level-I or -II recordings. $39.95.

The Peripheral People, Box 524, Mercer Island, WA 98040.

CIRCLE 296 ON READER SERVICE CARD

ELECTRONIC FILTERING DEVICE

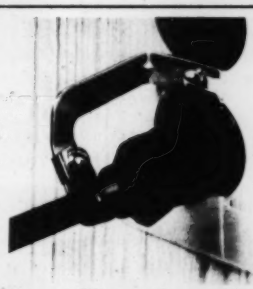
American Word Processing Company has introduced an electronic filtering device which is designed to protect minicomputers, text-editing typewriters, and automation systems from power surges, transients, voltage spikes and random line noise. Eliminates the need for a dedicated line.

American Word Processing Company, 18730 Oxnard St., Tarzana, CA 91356, (213) 705-2245.

CIRCLE 297 ON READER SERVICE CARD

POWER PROTECTOR

The Power Protector prevents loss of power due to unintentional "bumping" of



the plug or pulling on the cord. It is available for various cord diameters.

J.S. Popper, Inc., 200 Liberty St., Little Ferry, NJ 07643.

CIRCLE 298 ON READER SERVICE CARD

DATA ENHANCER FOR TRS-80

Microsette Co. has introduced the Data Enhancer, Model DE-80 for the Radio Shack TRS-80 Level-I or Level-II. The Data Enhancer is a black box that goes between the cassette deck and the TRS-80 to clean up and reconstitute poor quality cassette signals so they will load reliably with a volume setting of 4 to 10 on the recorder. $45.

Microsette Co., 777 Palomar Ave., Sunnyvale, CA 94086.

CIRCLE 299 ON READER SERVICE CARD

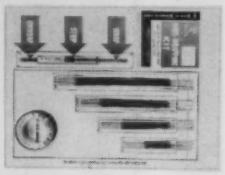
LOGIC PROBE KIT

Continental Specialties Corporation has introduced a logic probe kit. Once assembled, the LPK offers respectable performance as a logic probe. It is circuit powered through attached clip leads. HI, PULSE and LO LEDS display logic states and transitions. The High logic state is defined as 70% or more of the supply voltage, the Low state as 30% or less, making the probe compatible with most digital logic technologies, or families. With its high (300,000 ohm) input impedance, circuit loading is minimized. $19.95.

Continental Specialties Corporation, 70 Fulton Terrace, New Haven, CT 06509, (203) 624-3103.

CIRCLE 300 ON READER SERVICE CARD

WIRE WRAPPING KIT



A new Wire-Wrapping Kit includes a wire wrapping tool, a roll of wire-wrapping wire, and pre-stripped wire in 4 lengths. $12.95.

O.K. Machine And Tool Corporation, 3455 Conner St., Bronx, NY 10475.

CIRCLE 198 ON READER SERVICE CARD

INTRODUCING THE .4 MEGABYTE
DUAL DRIVE MINIFLOPPY FOR 8K PETS!

NEW!

NOW WITH 400K (.4 MEGABYTES) OF DISK STORAGE

CUSTOMER ORDERS ARE NOW BEING SHIPPED WITHIN TEN DAYS!!!

DKH641 IS A PRODUCT OF COMPUTHINK.

* DUAL MINI FLOPPY DRIVE WITH 100K PER DISK SIDE FOR TOTAL 200K ON LINE
* COMMERCIAL LOADING SPEEDS * 8K LOADS IN 2.6 SECONDS COMPLETE
* DOS REORGANIZES SPACE AFTER SAVE OR ERASE FOR EFFICIENT STORAGE
* DISMON ADDS OVER 20 COMMANDS TO BASIC INCLUDING DISK DATA FILES
* DISMON COMMANDS SUPPORT COMMERCIAL PRINTER OFF PARALLEL PORT SUCH AS CENTRONICS LINE OF PRINTERS (AVAILABLE FROM NEECO)
* FULL DISK SOFTWARE SUPPORT * FORTRAN & PLM COMPILERS *
* 90 DAY MANUFACTURER'S WARRANTY ON HARDWARE * READY TO USE ON DELIVERY. FULL MANUAL AND UTILITY DISKETTE INCLUDED.
* CALL OR WRITE FOR COMPLETE INFORMATION ON THE "DISKDRIVER"
* THIS SYSTEM REQUIRES EXPANDAPET MEMORY (MINIMUM 16K)

DKH642 — DUAL DRIVE SYSTEM, COMPLETE WITH DISKMON $1295.00
ASM780 — PET ASSEMBLER ON DISKETTE WITH MANUAL $49.95
*LNK456 — AUTOLINK LINKING LOADER ON DISKETTE WITH MANUAL $49.95
*PLM400 — COMPILER ON DISKETTE (AVAILABLE JUNE) $250.00

DKL067 — DISKMON ASSEMBLER LISTING/DOS $19.95
DATA100 — COMPLETE DATA BASE SYSTEM (PRICE APPROXIMATE) $400.00
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NGP200 — 20 GAMES ON DISKETTES $49.95
BKGAM — BACKGAMMON ON DISKETTE $24.95
MICRO — MICROCHESS ON DISKETTE $24.95
CEN779(1) — CENTRONICS 779-1, ROLL FEED DOT MATRIX COMMERCIAL PRINTER $1245.00
CEN779(2) — SAME AS 779(1) BUT WITH TRACTOR FEED — PLUG INTO PET $1345.00
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* WE ALSO MARKET REPLACEMENT RAMS & ROMS, ETC.
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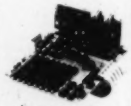
INTERNAL MEMORY EXPANSION FOR PET!

EXPANDAPET™

INTERNAL MEMORY EXPANSION UNIT FOR 8K PETS



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*90 DAY PARTALABOR, 1 YR RAMS
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*CALL/WRITE FOR ADDITIONAL INFO
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32K UNIT ALLOWS 8K OF ASSEMBLY LANGUAGE SUBROUTINES ACCESSED VIA THE USR COMMAND.

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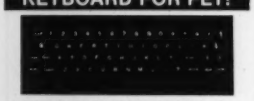

*COMMERCIAL QUALITY KEYBOARD WITH METAL ENCLOSURE.
*BASIC TYPEWRITER DESIGN FOR TOUCHTYPISTS.
*SINGLE KEY FUNCTIONS FOR ALL CURSOR CONTROLS. SHIFT/RUN, INSERT, CLEAR SCREEN/HOME CURSOR, MORE.
*FUNCTIONS SIMULTANEOUSLY WITH PET'S KEYBOARD.
*PLUGS DIRECTLY INTO PET'S LOGIC BOARD.
*DOES NOT USE USR OR IEEE 488 PORTS.
*NPK-101 IS FULLY TESTED & READY TO USE.
*ATTACHES DIRECTLY TO FRONT OF PET'S FRAME.
*CAN BE USED AS A REMOTE TERMINAL (SPECIAL ORDER).
*30 DAYS TRIAL PERIOD * 90 DAY WARRANTY.
*CALL OR WRITE FOR FULL SPECS

NOW AVAILABLE! $139.95

NPK-101 IS A PRODUCT OF NEW ENGLAND ELECTRONICS.

OUR NEW JUNE PET CATALOG IS NOW AVAILABLE.
CALL OR WRITE FOR OUR *FREE* PET PRODUCTS CATALOG.
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Order #	Description	Cassette	
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1979 SAT TRAK

CIRCLE 170 ON READER SERVICE CARD

CIRCLE 108 ON READER SERVICE CARD

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- **Western Digital's Pascal MICROENGINE™ Computer** $2995.00
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  - UCSD Pascal (Release 3.0)
- **Dual 8 inch Floppy Disk Drive System** $2495.00
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  - Disk Drive Cable
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CIRCLE 156 ON READER SERVICE CARD

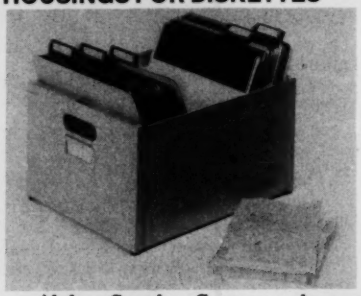
FLOPPY DISK STORAGE RACKS

Sturdy, walnut finish floppy disk storage racks hold 22 or 44 standard size floppy disks. Two minidiskette models are also available.

American Word Processing Company, 18730 Oxnard St., Tarzana, CA 91356, (213) 705-2245.

CIRCLE 199 ON READER SERVICE CARD

HOUSINGS FOR DISKETTES



Alpha Supply Company has announced a media housing for diskettes and mini-diskettes. These housings are offered as a complete outfit: the Flexi-Matic for standard 8" diskettes and the Mini-Matic for 5¼" mini-diskettes. Each consists of scratch resistant steel tray with carrying handles, supporting plates to hold the media in an upright position, one set of indexes with insertable tabs, and a dust cover. Additional support plates, index sets, and a locking steel hood are also available. The Flexi-Matic outfits are priced at $54.75 for the FM-1 and $37.00 for the FM-2. The Mini-Matic is $28.50.

Alpha Supply Company, 9625 Mason Ave., Unit 8, Chatsworth, CA 91311, (213) 882-9818.

CIRCLE 200 ON READER SERVICE CARD

GARDNER GRINDER FOR FLAT SURFACES
15 to 21 Clinton Street.

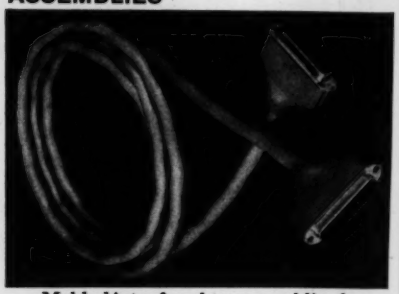
ACCESSORIES GUIDE

An 84-Page illustrated "Guide To Word Processing Accessories and Supplies, 1979 Edition," describing almost 1,300 items for word and data processing installations is available from AWPC. Included are many new diskette and minidiskette storage systems, anti-static mats, CRT work stations, a fireproof media safe, competitive brands of Diablo and Qume ribbons, two new lines of durable plastic printwheels, thimbles and ribbons for the NEC Spinwriter printers. Free.

American Word Processing Company, 18730 Oxnard St., Tarzana, CA 91356, (213) 705-2245.

CIRCLE 201 ON READER SERVICE CARD

RS-232 MOLDED CABLE ASSEMBLIES



Molded interface bus assemblies have been introduced by Belden Corp.'s Electronic Div. for serial binary data exchange between data terminal and data communications equipment. The 25-conductor assemblies, available in standard lengths of 10, 25, 50, and 70 ft., enable fast, accurate hookup of data system components equipped with Type A to Type M RS-232 interfaces. 10-ft., $24.90; 70-ft., $60.90.

Belden Corp., Electronic Div., P.O. Box 1327, Richmond, Ind. 47374, (317) 966-6661.

CIRCLE 202 ON READER SERVICE CARD

ATTENTION
APPLE II OWNERS

Southeastern Software announces ready to run programs on tape for your computer . . .

Send $5.95 plus 50¢ postage and handling for demo tape and sample newsletter designed for Apple II owners.

Demo tape includes 1 game and 2 general interest programs. Specify if you want tape to run in BASIC, Applesoft or Applesoft II.

SOUTHEASTERN SOFTWARE
Dept. CC 7270 Culpeper Drive
New Orleans, LA 70126

CIRCLE 185 ON READER SERVICE CARD

North Star Doc

DOCUMENTATION	• Prints formatted program listings (user selected spacing, titling, dating, and automatic paging) • Prints cross reference table of all program variables • Prints cross reference table of all 'GOTO' type statments
OPTIMIZATION	• Concatenates short lines into multiple statement lines of user selected length (Max=255 chars/line)
SPEED	• Faster execution of 'GOTO' type statements (up to 75% reduction in the number of lines of coding allows basic to locate the destination of a 'GOTO' type statement faster) • Fast effecient subroutine to implement 'GOTO N' type statement
SIZE	• Typically reduces program size by 35% • Removes all blanks not enclosed in quotes • Optionally removes all REM statements except those that are the target of a 'GOTO' type statement • Saves three bytes for every statement concatenated
CONFIDENTIALITY	• Optionally inhibits the correct functioning of the North Star Basic 'list' and 'edit' commands if the user specified line length exceeds 132 chars/line

DOC runs on release 4 or 5 of North Star Basic, single or double density drives. Minimum of 32K memory required. $59.00 price includes diskette and instructional manual. Order your copy from:

Mini Business Systems
P.O. Box 15587
Salt Lake City, Utah 84115
PH: (801) 467-1571

CIRCLE 167 ON READER SERVICE CARD

PULSEMAKER

It's a digital signal injector. And it thinks for itself.

It may look like a logic probe . . . but our DP-1 Digital Pulser is a lot more unique. This handheld, circuit-powered instrument is actually a miniature pulse generator built to speed digital troubleshooting.

Touch it to a circuit, and DP-1 automatically senses the logic state. So when you push the button, out comes one perfect pulse—preset to the logic family you're working with—of the proper polarity to force the state the other way. Hold the button down for a second and it starts injecting a 100pps pulse train. With all the punch you need—up to 100 mA.

Think what a help that can be when your logic circuit is doing something illogical. (And just in case *you* do something illogical, we've included reverse-polarity and short-circuit protection, as well.)

It's smart to save time with a DP-1. At $74.95*, it's a smart buy, too.

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*Suggested U.S. resale. Available at selected local distributors.
Prices, specifications subject to change without notice.
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CIRCLE 102 ON READER SERVICE CARD

MINIDISKETTE VINYL ORGANIZER

Three-hole punched, non-glare organizer is designed for binder filing of minidiskettes. Contains two pockets for minis, a small slot to the right of each pocket for a "Table of Contents" card, and a large pocket for hard copy. Also offered is a model which utilizes both sides for double the capacity. Free sample upon request.

American Word Processing Company, 18730 Oxnard St., Tarzana, CA 91356, (213) 705-2245.

CIRCLE 203 ON READER SERVICE CARD

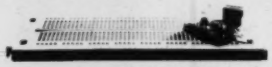
HEAT-SEALABLE CASSETTE HOLDER

Producers, designers and packagers of audiovisual programs that include tape cassettes will be interested in Pocketray, a cassette holder from Charles Leonard, Inc. The unit will receive the cassette from either side and hold it securely with the title visible. There are 12 Pocketrays to a sheet that is perforated vertically and horizontally. These may be snapped apart into single units or in any multiple to fit the most creative configuration. Made of PVC, these cassette holders are easily heat-sealed to any vinyl material, with a minimum of tooling.

Charles Leonard Inc., 79-11 Cooper Avenue, Glendale, NY 11227, (212) 894-4851.

CIRCLE 204 ON READER SERVICE CARD

BREADBOARDS, PC BOARDS



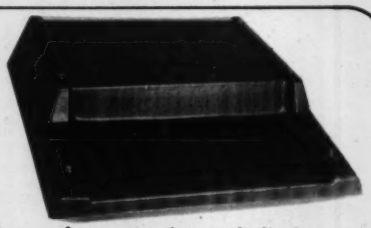
Continental Specialties Corporation has complemented its Experimentor series of solderless breadboards with matching etched circuit and printed workpad products. The company calls the result The Experimentor System, an approach to translating circuit ideas into hardware. With Experimentor Scratchboard workpads, a designer doesn't have to have his components in hand to begin the breadboarding task.

Continental Specialties Corporation, 70 Fulton Terrace, New Haven, CT 06509, (203) 624-3103.

CIRCLE 205 ON READER SERVICE CARD

MICROPROCESSOR CASE

JRF-Tronics introduces a low-cost microprocessor case for the computer enthusiast who has a single board or multi-card system and wants an enclosure for protection and display, or wants to upgrade metal/fiberglass enclosure.



The contour-formed Royalite unit, dubbed Computer Enclosure CE-18 provides for effortless mounting with it's easily modified chassis—for connector mounted multi-card or single card systems. The keyboard can be either self-supported or mounted on stand-offs from the bottom of the case. Standard color is walnut woodgrain. This durable plastic molded case can be easily worked with power or hand tools for keyboard cutout. It has an unplated metal 'H' chassis that can be adjusted for card mounting. Outside dimensions: 18" wide, 19" deep, 8" high. $54.95.

JRF-Tronics, Inc., 1061 N. Shepard, Unit D, Anaheim, CA 92806, (714) 630-0600.

CIRCLE 206 ON READER SERVICE CARD

EASILY EARNED

Men's and Women's High Grade Bicycles, Watches, Sewing Machines, Furniture, Cameras, Mandolins, Shoes, Tea Sets, Guns, etc., etc., can be earned by a few hours' work introducing our high grade Toilet Soaps among your friends and neighbors. No money required. We trust you. Write for our handsome illustrated catalog of over 100 premiums and full information at once. Address

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In the ML version, the sort will take from 1 to 20 SECONDS, depending on the number of records being sorted. The BL version of the sort takes between 10 seconds and 15 minutes.

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Robert W. Soel, Advertising Coordinator, Howard W. Sams & Co., Inc., 4300 W. 62nd St., P.O. Box 558, Indianapolis, IN 46206.

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Opamp Technical Books specializes in computer books, cassettes, and magazines. It has been said that their stock exceeds the largest book stores in New York. Chances are they have that hard-to-find title you might be seeking. Phone and mail orders welcome.

Opamp Technical Books, 1033 N. Sycamore Ave., Los Angeles, CA 90038, (213) 464-4322.

CIRCLE 208 ON READER SERVICE CARD

COMPUTER SELECTION GUIDE

The "Correlation Guide to Desktop Computer Selection" identifies hardware/software characteristics of desktop computers, provides a ready reference for comparing various portable desktop system capabilities, and serves as a basis for determining systems compatibility to aid in the development of more flexible, transportable software. The guide includes a general description of each manufacturer's product line and appropriate comparisons with the system lines offered by competitors. The systems described in detail include the TRS-80, APPLE II, IBM 5110, and the Hewlett-Packard 9800, Tektronix 4050, and Wang 2200 series desktop computers. $14.95.

Atlantic Analysis Corporation, 5 Koger Executive Center, Suite 219, Norfolk, VA 23502.

CIRCLE 209 ON READER SERVICE CARD

BASIC BOOK

BASIC for Home Computers uses Microsoft BASIC and teaches the reader how to read, write, and understand BASIC. The information is presented in frames so that the reader learns how to write a program. Numerous applications and games are included. $5.95.

John Wiley and Sons, Inc., 605 Third Ave., New York, NY 10016.

CIRCLE 210 ON READER SERVICE CARD

SOFTWARE TESTING

Available from Auerbach Publishers Inc. is "Software Testing." The two-volume report looks at the reasons for the advances in testing methodology describes current theory of testing and the latest tools and techniques. Detailed discussions included are the history of software testing and the motivations behind the development of new techniques; the theory of testing; new testing techniques, themselves; testing tools; and the management of testing. $295.

Department ICR, Auerbach Publishers Inc., 6560 North Park Dr., Pennsauken, NJ 08109, (609) 662-2070.

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STRUCTURED SOFTWARE DEVELOPMENT

Recently released, the latest of the 1979 Series of Computer State of the Art Reports from the INFOTECH International, "Structured Software Development" is available from Auerbach Publishers Inc. It investigates the latest thinking concerning requirements analysis and specification, resource estimation for software development, program design methodology, software maintenance, and the role of the behavioral sciences in software project management. Such areas as the aims of structured software development; the software life-cycle; the design process and attendant computer aids; implementation, integration and validation of structured programming; managing the maintenance process are presented in detail. $295.

Department ICR, Auerbach Publishers Inc., 6560 North Park Dr., Pennsauken, NJ 08109, (609) 662-2070.

CIRCLE 217 ON READER SERVICE CARD

GUIDE TO DIGITAL EQUIPMENT CORP. MAINTENANCE

Alltech has introduced a business manager's guide to the maintenance services offered by Digital Equipment Corp. The report, **Digital Equipment Corp. Maintenance**, gives managers answers to such questions as: What contract maintenance services are offered by Digital?; What non-contract maintenance services does Digital offer?; If a system is not currently maintained by Digital, what are Digital's procedures for reinstating maintenance?; What unique or special maintenance services does Digital have to offer? $5 (prepaid).

Alltech Publishing Company, 212 Cooper Center, Pennsauken, NJ 08109, (609) 662-2122.

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Sybex announces ten time-efficient, self-study packages, each including a workbook plus two to eight audio cassettes. The courses, most of which have been recorded live, teach all aspects of microprocessors and small computers from introductory to highly specialized levels.

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MAGAZINES

SE SOFTWARE NEWSLETTER

The Southeastern Software is published as a guide to beginners new to personal computing and the APPLE II. It is written with the idea in mind that many APPLE II buyers have had no previous computer experience and would like to learn the operation of their Apple from the ground up. $10.00 for 10 issues.

Southeastern Software, 7270 Culpepper Dr., New Orleans, LA 70126.

CIRCLE 220 ON READER SERVICE CARD

PROG/80 MAGAZINE

PROG/80 is a new magazine for the the TRS-80 microcomputer programmer. Among the features are tutorials on getting the most out of programming commands, using the ports and graphics of the TRS-80, programming ideas, hardware applications, Tandy developments, and other articles of interest to the serious hobbyist or beginning professional using the Radio Shack Computer. The magazine will be published at intervals of two to three months and is available at a subscription rate of $10 for four issues.

PROG/80, P.O. Box 68, Milford, NH 03055, (603) 673-5144.

CIRCLE 221 ON READER SERVICE CARD

ORGANIZATIONS

PROGRAM ABSTRACTS

The National Computer Program Abstract Service (NCPAS) has over 33,000 abstracts in its data base. These abstracts include computer simulation models, application/computational programs, and information retrieval systems covering all fields of knowledge from business, government, industry, military, and universities. NCPAS provides valuable services for those involved with models, computer programs, or information retrieval systems—including present or potential users, those selling computer programs, and other developing models in the academic community. Any organization can place its computer program abstracts in the NCPAS data base free of charge.

The program information is disseminated in two forms: (1) a quarterly program index newsletter, "ABSTRACTS," which includes the number of abstracts available on each subject (cost—$10 per year); and (2) Abstract Reports which provide all the abstracts within a subject area (cost—$29 for the first 200 abstracts and $10 for up to each additional 200 abstracts).

For additional information and a free copy of "ABSTRACTS," write to NCPAS, P.O. Box 3783, Washington, D.C. 20007.

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NATIONAL COMPUTING NETWORK FOR HIGHER EDUCATION AND RESEARCH

EDUNET is a network formed to facilitate interuniversity computer resource sharing. EDUNET will organize as a functional activity of EDUCOM, as association of more than three-hundred colleges and universities. The network staff maintains its offices at EDUCOM headquarters in Princeton, NJ.

EDUNET Central, P.O. Box 364, Princeton, New Jersey 08540, (800) 257-9505 or (609) 921-7575.

CIRCLE 223 ON READER SERVICE CARD

INTERNATIONAL ASSOCIATION OF COMPUTER USERS

A new, broad-based international association for computer users has been formed in Boulder, CO. The most important function of the new association will be the continuation and expansion of a series of studies originated by ASCU fo its members.

Membership in ACU is available at $25 per year, which includes membership in one section. The sections are: Small Computer, Midi Computer, Large Computer, Word Processing, Distributed Processing, Home & Hobbyist, Time-Sharing.

Membership requests may be sent to: The Association of Computer Users, P.O. Box 9003, Boulder, CO 80301.

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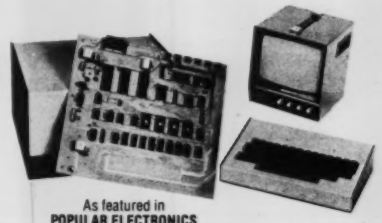
EXPLORER/85 gives you "big computer" features immediately, without turning you into an appliance operator, doomed to run pre-developed software for life. Simply connect EXPLORER to a terminal, video monitor or tv set and 8 volt power supply and start running programs, the very first night! Level "A" teaches you machine language and computer fundamentals. It lets you run exercise programs including programs to examine the cpu registers, examine memory, fill memory, move memory and make up games. You can load and play back these programs on an ordinary tape cassette—and display your efforts on any tv screen, video monitor or printer. ($8.95 RF modulator required for tv use.) The simplified architecture of the Intel 8085 makes EXPLORER far easier to understand than computers using the older, more complex but less powerful 8080A. Then, when you're ready, EXPLORER can be expanded—by you—to rival the power of any 8-bit computer on earth. Or you can customize it to perform a dedicated task, thanks to onboard prototyping, RAM and ROM expansion capabilities.

LEVEL "A" SPECIFICATIONS

EXPLORER's Level "A" system features an advanced Intel 8085 cpu, which is 50% faster than its 8080A predecessor, yet 100% compatible with 8080A software . . . which, you'll discover, exists by the ton. "Big computer" features include an 8355 ROM with 2K deluxe monitor/operating system which has two programmable 8-bit bi-directional parallel I/O ports, built-in cassette interface with tape control circuitry to allow labeling cassette files, and commands which include: "display contents of memory," "run at user location (go to)," "insert data," "move contents of memory," "examine registers individually or all," fill command (to fill the contents of memory with any variable), automatic baud rate selection, programmable characters per line display output format, and more! An 8155 RAM—1/O chip contains 256 bytes of RAM, two programmable 8-bit bi-directional and one programmable 6-bit bi-directional I/O ports plus programmable 14-bit binary counter/timer, user interrupt and reset switches. Onboard expansion provisions exist for up to six S-100 boards, 4K of RAM and 8K of ROM, PROM or EPROM.



As featured in
POPULAR ELECTRONICS

EXPLORER/85 shown with Video Monitor and Keyboard/Video Terminal.

CHOICE OF HEX KEYPAD OR TERMINAL INPUT

If you plan to customize EXPLORER for dedicated use, we recommend that you order hex keypad input. But, if you are planning to go whole hog and blow EXPLORER up into a full size, state-of-the-art system with 8K or extended basic (coming soon), up to 64K of memory, floppy disks, telephone interface, printers, and all sorts of S-100 plug-ins—you'll be better off with the Keyboard/Video Terminal input. The $149.95 EXPLORER Keyboard/Video Terminal includes full ASCII decoding with 128 ASCII upper/lower case set, 96 printable characters, onboard regulators and selectable display formats—32x16 for tv set or 64x16 for video monitor (not included).

EXPAND EXPLORER, LEVEL-BY-LEVEL

Level "B" expansion, at $49.95, adds S-100 signals plus onboard RAM/ROM decoding. Includes all parts necessary to generate the signals for S-100 bus accessories. Just add two S-100 bus connectors and you have a complete S-100 compatible computer with a world of add-ons at your fingertips. Choose from hundreds of products to satisfy your individual needs. Level "B" kit also includes the address decoders for onboard RAM and ROM expansion, which are addressable anywhere in the 65K field.

Level "C" expansion, at $39.95, expands the S-100 bus to allow a total of six S-100 cards to be plugged into EXPLORER's motherboard and contained in EXPLORER's steel cabinet. Includes all hardware, mounting brackets, board guides, etc. Just add the number of S-100 bus connectors you need.

Level "D" expansion, at $69.95, gives you 4K of onboard static RAM utilizing 2114 IC's. Your board will also accept four 2716 EPROM's, which can be purchased separately. You now have an advanced mainframe that can be customized with the peripherals of your choice to fit any (or all) specific requirements. Each level of EXPLORER is separately regulated for the ultimate in stability. Factory service is available from Netronics. **Order your EXPLORER today!**

ORDER FROM THIS COUPON TODAY!

Netronics R&D Ltd., Dept CC-7, 333 Litchfield Road, New Milford, CT 06676

- ☐ Level "A" EXPLORER/85 kit (specify ☐ terminal or ☐ hex keypad input), $129.95 plus $3 p&h.
- ☐ Power Supply kit, 5 amp, ±8 volt, $34.95 plus $2 p&h.
- ☐ Intel 8085 User's Manual, $7.50 ppd.
- ☐ ASCII Keyboard/Video Terminal kit, $149.95 plus $3 p&h.
- ☐ Hex Keypad kit for hex version, $69.95 plus $2 p&h.
- ☐ Level "B" S-100/Onboard RAM/ROM Decoder kit (less S-100 connectors), $49.95 plus $2 p&h.
- ☐ Level "C" S-100 5-Card Expander kit (less connectors), $39.95 plus $2 p&h.
- ☐ S-100 Bus Connectors (gold), $4.85 each.
- ☐ Level "D" 4K Onboard RAM kit, $69.95 plus $2 p&h.
- ☐ Deluxe Steel Cabinet for EXPLORER/85, $39.95 plus $3 p&h.
- ☐ Deluxe Steel Cabinet for Keyboard/Video Terminal, $19.95 plus $2.50 p&h.
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MINNESOTA'S INCARCERATED COMPUTER

Jim Willman, operations manager of Stillwater Data Processing Systems, Inc., is currently serving time in the Minnesota State Prison. Not because of data depredation, but because the Stillwater, Minnesota, prison is the new data firm's main office.

Consequential customers of the caged computer company include General Mills, Blue Cross-Blue Shield of Minnesota and the Northern States Power Company as well as many departments of state and local government. Prisoner Willman, member of the firm's board of directors, says, "Stillwater Data is really growing. I think we've got a strong future."

The data firm began in June of last year with the help of 8-year computer veteran William Ward and four major computer manufacturers who offered assistance and expertise in setting up the new business.

The company is the product of a new Minnesota law which allows private businesses to go behind bars to help prepare inmates for worthwhile jobs. Other such prison factories are producing golf balls, fishing lures and fence posts.

President Ward, who was hired from outside the prison, says, "Our revenues were about $6,500 in December and we expect Stillwater Data to grow rapidly in the next few months."

Ward notes the main problem the new corporation is facing is not marketing, but training. He says the firm has trained 15 men, but half either dropped out or could not handle the work. There are currently three men working in the 1,000-square foot office at the prison which the company leases. There are three other employees outside the prison working for the firm on a work-release program.

Ward recognizes the rehabilitation aspect of the firm, but says "Stillwater Data is a business, not a sociological outlet. We must deliver a quality service at a competitive price. That has to be our major goal."

Inmate Willman says he averages $4.62 an hour compared with the average inmate shop wage of $1.75.

"I'm counting my days and my dollars," says Willman. "When I leave prison in two years I figure I'll have saved up over $16,000!"

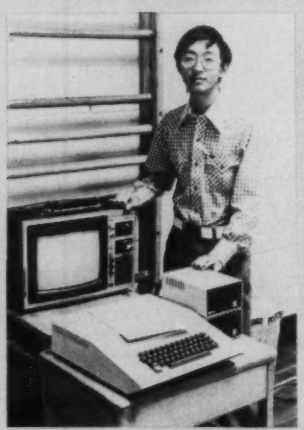
Will he stay in computer work? "Yes!" Why? "I like the challenge."

Dan Ramsey

KEMENY TELLS VALUE OF COMPUTER

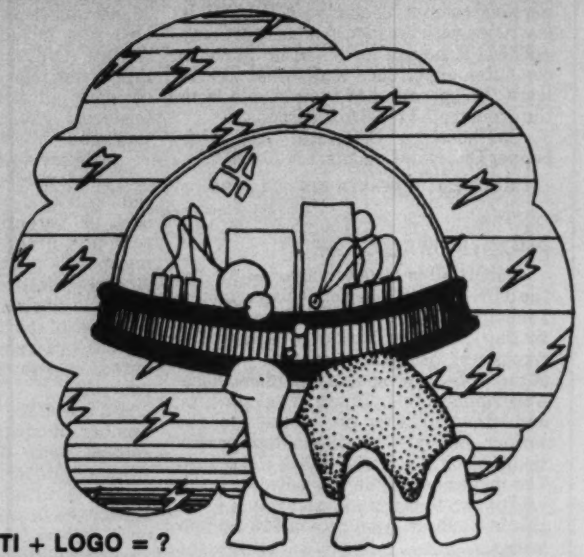
Responding to the question, "Why, in these times of tight budgets, did the board of trustees allocate two million dollars for a new computer?" Dartmouth President John G. Kemeny noted, "the computer makes the student a little smarter, and the faculty and administration a great deal smarter."

Speaking before more than 200 women college administrators, faculty and staff who had gathered for a two-day conference on the use of computers in higher education, President Kemeny further cited the necessity of computer modelling for use in long-range planning: "The computer allows many people to interchange thoughts and ideas in long-range planning and to play the game of 'what if' with such things as rates of inflation, fuel prices and student body size in any and all combinations. The computer is the single most important element of long-range planning."



HEATING COSTS VIA COMPUTER

Jeff Yuan, a sophomore at Morristown High School, New Jersey, won the AT&T Corporate Award in the SEER (Student Exposition on Energy Resources) competition in May. In the next stage of competition, Jeff was one of the eight top winners in SEER 5 and won the Union Pacific Corporate award. Jeff's project was a computer program that showed how much energy was required and the cost to heat a house varying the dimensions, materials and fuel used. The computer, an Apple II, was loaned to Jeff by Creative Computing. Jeff's programs also run on the Sorcerer which he used in the New York competition.



TI + LOGO = ?

Dr. Seymour Papert of MIT's Artificial Intelligence Lab is one of the most enthusiastic and imaginative people in terms of using computers in education. Back in the late 60's he proposed a new language, LOGO, to manipulate physical objects, mainly a "turtle" which traced its path on giant sheets of kraft paper. More important was his conceptual notions of using the computer to let kids discover on their own important mathematical and geometric principles.

Unfortunately, the big NSF grants went to PLATO and TICCIT and LOGO never got enough to establish anything but a few small pilot installations. Seymour's brother, Alan with some backing from an Australian financial group set up a company, General Turtle, to manufacture and market electronic turtles, music boxes and other LOGO paraphernalia. Again, unfortunately timing wasn't good because the company's products were developed about a year before the advent of microprocessors and, as a result, were overly costly compared to the newer technology. General Turtle retreated to Canada and is operating there on a much reduced scale compared to the original projections.

However, there always remained the dedicated pockets of hard core LOGO enthusiasts. It looks now as though they will finally see some of their ideas put into practice. Eric Johnson, one of the founders of Texas Instruments has agreed to have the microcomputer division of TI make 100 prototype LOGO computers. (We don't know if these will include turtles. The turtle today seems to have shrunk to a small triangle on the CRT screen, although LOGO proponents claim the educational principles and learning-by-discovery are not diminished.)

These computers will be installed in the Lamplighter School, a private school in Texas. Here the kids will have virtually unlimited access to the systems, indeed they'll even be able to check them out like a library book and take them home to pursue outside projects.

Obviously, there are many implications of this project that can only be speculated upon at this time. For example, will TI make these systems commercially? Will LOGO be available on TI's personal computer? And most fundamental, will LOGO really revolutionize learning to the extent Seymour Papert believes?

We'll be watching with baited breath.

— DHA

COMPUTER READS FINGERPRINTS

"A fingerprint is the strongest kind of evidence," says San Jose Police Chief Joseph McNamara. "It often means the game is up and you get a guilty plea." McNamara and the San Jose police have already identified eight lawbreakers, including a rapist and an armed robber, with the help of a

pattern-recognizing computer. The machine is able to compare "latent," or invisible, fingerprints found at the scene of the crime with prints of people whose criminal records are stored in the computer's data base.

San Jose's computer system is still in its test stage and is relatively slow, taking sixteen hours to compare one suspect's prints with its data base of 17,000 criminal prints. But when the system is complete, it will scan the entire file in several minutes.

The system is based on computer recognition of a fingerprint's pattern and "munutiae." First, a latent print is enlarged on a screen. The pattern type (arch, loop, or whorl) and the suspect's age, sex, race, hair color, height, and weight are entered on the keyboard. Then the operator moves an electronic pointer over the print's surface, aligning it a dozen times with minutiae, the ridge endings or forks. In a few seconds, a printer lists thirty-three suspects ranked in the order of probability that their minutiae match those of the latent.

San Jose's system is being watched by police the world over. Police in the Minneapolis-St. Paul area have ordered a similar system that will become a statewide network connecting local police with a central identification bureau. The New York State and Buffalo, New York police have ordered systems. The Royal Canadian Mounted Police, the FBI, and the German national police also have similar plans.

COMPUTERS ANALYZE ATHLETIC PERFORMANCE

Coaches have been analyzing athletes' movements with the goal of improving performance probably for as long as competitive sports have been played.

Technology, however, with the use of high-speed cameras, computers and statistics, is metamorphosing the art into a science.

Students in a graduate course at The University of Texas are learning how to combine the art of coaching and a sense of the game with a knowledge of biomechanics and the use of sophisticated equipment to analyze movement in sports.

Students concentrate on basic scientific principles of human

movement such as balance, linear motion, rotation, force production, accuracy and limb manipulation and then apply those principles to specific sport situations.

"They use a fairly fast camera speed so it is sort of like slow-motion photography. They actually stop the film to do a frame-by-frame analysis of movement. As the body moves from frame to frame, they can see how it moves over a period of time. It is a good chance to quantify movement," said Dr. Larry Abraham who teaches the course.

Abraham explained that computers can be combined with the film process to provide analysts with highly refined information, unquestionably more detailed than a naked eyeball analysis would yield.

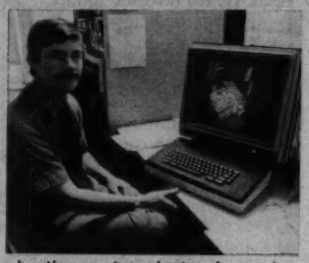
Such computer analysis, however, is beyond UT's capacity. The equipment is there but not the computer program. "We are in the process of working it up, and within a couple of years we should be able to be close to the best that is being done now," he says.

To analyze and improve movement, one must understand its goal. "Most movements in sport are means to an end — swinging a bat or a tennis racket, kicking a football, and some movements are ends in themselves — dance, diving, gymnastics — which changes the approach to analysis," Dr. Abraham explained. "Analysts also must recognize personal style in performance and make allowances for it," he added.

The analyst offers only suggestions, no guarantees, but the analysis of athletic performance has other uses. For sports equipment manufacturers interested in developing safer gear, analysis can help determine where stress is being placed on the body and how it can be relieved. In the field of rehabilitation, amputees can learn to manipulate prosthetic devices as naturally as possible.

Dr. Abraham is especially interested in the assistance biomechanics can provide the poor performer in athletics. "There are lots more poor performers than good performers, and they have lots more room to profit by this analysis. The kinds of problems that poor performers have are mechanical problems. Through the use of biomechanics they can become good performers and enjoy sports more because they can achieve their goals."

COMPUTERS AID ARCHITECTURE



"The time is coming, and it may be in the very near future," says Charles Eastman, "when the computer will become as common an architectural design tool as the T-square and triangle."

Eastman, a professor of architecture, computer science, and urban affairs at Carnegie-Mellon University, can sit down at a console and, by giving the right commands, call up various drawings of a building to a computer-driven TV screen and make changes in the building's configuration.

It only takes a minute or two, for instance, for Eastman to call up on the screen any plan, section, evaluation, or perspective of the University's administration building, a six-story office complex. The computer can provide perspective or orthographic displays of the structural elements, exterior panels, plumbing, mechanical equipment or interiors. Any number of elements such as the heating system ductwork can be added or subtracted by pressing a few keys.

Eastman's system would not do away with the architect's traditional function of design; he would still have to use his technical and aesthetic judgement. "A great part of the architect's cost now is in the time it takes to produce the drawings," says Eastman. "If we can get a computer to produce those detailed drawings, it will cut down drastically on the time and, therefore, the cost of an architect's work."

Carnegie-Mellon Alumni News

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...compendium...

HOW SECURE IS COMPUTER DATA?

The proposed key for a security system designed to lock up the vast quantities of information stored in U.S. computers is "too small" and "within fifteen years will be rendered totally insecure" in the opinion of two Stanford computer experts, Martin E. Hellman and Whitfield Diffie.

If the Secretary of Commerce approves it, the key proposed by the National Bureau of Standards and the National Security Agency will become a required standard for most federal agencies and a **de facto** standard for all computer users.

The system consists of a kind of combination lock called an "algorithm" which is an encoding computer program. When the user puts his key into the algorithm lock and feeds information into the machine, it is stored or sent to the recipient in coded form. The key to the lock is a series of fifty-six digits, zeros and ones, arranged in any order. The large number of possible arrangements of these digits-approximately 100 million billion — gives the appearance of a high level of security.

But Hellman and Diffie hold that the so-called "56-bit" key is not all that secure, that such a key could be broken in a day by anyone with enough money to build the trial and error machinery to search the 100 million billion keys. They believe it significant that this would probably be too costly an investment for a private firm but not too much for a government agency — say to NSA or CIA.

"While it is well established that a larger number of keys does not guarantee security," says the Stanford pair, "too small a number of keys guarantees insecurity." The Stanford experts have urged a much higher standard with at least 128 key bits, which the computer users could employ wholly or in part. It would then be impossible to break the key by trial and error.

"Adoption of a standard with built-in obsolescence is not justified," they conclude.

The Stanford Observer

OPEN SESAME

Passwords and keys are presently the most popular forms of information used to control access to computers. Yet the amount of private information stored in computers is growing, and more sophisticated techniques will soon be needed to match the demand for security. Therefore, scientists are looking into the use of unique physiological characteristics as a means of verifying identity.

A computer is simply trained to measure a certain attribute and to recognize those measurements when next presented. Recognition systems based on signatures make use of force, velocity, and acceleration rather than the static image of the signature. A voice recognition system can select a phrase at random from a set of previously stored words for a person to speak into a microphone. A computer can also perform an optical correlation between a fingerprint and a file copy. The length of fingers varies enough to form a recognition system; the Air Force discovered this fact while measuring a large number of hands to obtain standards for making gloves.

An individual's profile is formed by programming an original set of measurements from which a set of averages and limits are obtained. Some systems include an adaptive process that can follow change, such as aging. Soon, access to information stored in computers will no longer be as simple as "Open Sesame."

COMPUTERS HELP UNEARTH THE PAST

Computer technology has joined the pick, shovel, and drill to help Northwestern University archeologists at the largest excavation site in North America. Archeologists working at the Koster site in southern Illinois rely on a Control Data 6400 computer that is 300 miles away to keep track of their findings and to determine where to begin the next excavation.

In addition to information unearthed at the Koster site, pertinent data recovered from some 800 different archeological sites in the 2,800-square-mile research area is entered through a terminal for relay to the computer. At Northwestern's Vogelback Computing Center, the computer uses a university-developed data-base program designed to handle the varied data of individual researchers.

From information entered on terminals at the excavation headquarters, the computer builds a file for each of the 800 sites. Each file is structured to hold 145 items of information about the site and excavation results. Site description includes name, location and size of the

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excavation, names of the archeologists involved, where the artifacts from the site are stored, and what has been photographed.

The survey information sent to the computer relates to soil conditions and evidence of cobbles and limestone (indicates cooking and pottery, and tool making) and animal bone (means there is favorable preservation at the site). Of the 145 slots of information storage for each site, 123 are for listing the artifacts uncovered — the data most important to archeological analyses.

IS HAZEL A WITCH?

"Death be not proud," as John Donne says, for a computer named Hazel has got your number. The Hazeltine 2000 is used in a health-hazard appraisal system developed at the University of Wisconsin, and it can tell anyone the risk factors in their lifestyle that threaten longevity.

Hazel receives data on the most likely causes of death for individuals of a specific age, sex and racial group. The causes include motor vehicle accidents, suicide, homocide, machinery accidents, pneumonia, stroke, and heart attack. These causes (there are fifteen in all) are correlated with risk factors such as use of alcohol, amount of exercise, smoking habits, and use of seat belts.

For example, a healthy, 31-year-old woman who plays tennis five times a week found that her statistical risk of dying within the next decade was just a fraction above those for the average white woman in the 30-to-34 year age group. Hazel suggested that the woman stop smoking and drinking and buckle her seat belts.

"What we are trying to do," says Laurence Van Cura, a computer specialist, "is inform people of what the risks are for certain types of behavior in hopes that the individual will change. The emphasis is to shift medicine to a period before the problem arises."

Trish Todd

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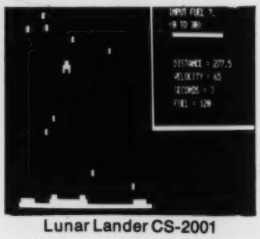
Lunar Lander CS-2001

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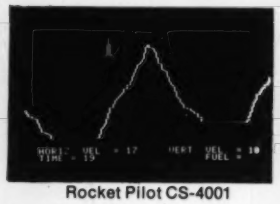

Rocket Pilot CS-4001

Baseball CS-4002

APPLE II **CS-4002**

SPORTS GAMES-1 (4 Games)

1. **Baseball**—control infielders and outfielders, type of pitch and swing of bat (2 players).
2. **Torpedo Alley**—sink ships with your torpedoes.
3. **Slalom**—ski downhill through the gates in minimum time.
4. **Darts**—use game paddles to hit the bulls-eye.

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4. **Blockade**—build walls. Sound and speedup (1 or 2 players).
5. **Genius**—challenging trivia quiz.

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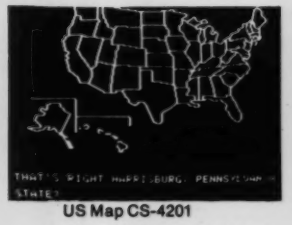

US Map CS-4201

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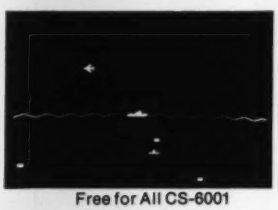

Free for All CS-6001

SUPERBOARD II/CHALLENGER 1P (8K) **CS-6001** **$7.95**

GRAPHIC GAMES-3 (4 Games)

1. **Tank Attack**—seek and destroy enemy guns hidden among houses and trees before they get you.
2. **Dodgem**—get your pieces across the board first.
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4. **Hidden Maze**—find your way through an invisible maze.

Exidy Sorcerer

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GRAPHIC GAMES-2 (6 Games)

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LOGIC GAMES — 1 (6 Games)

1. **Awari** — Ancient African logic game with 12 pits and 36 beans.
2. **Bagels** — Guess a secret 3-digit number.
3. **Chomp** — Avoid the poison corner on the cooky.
4. **Flip-Flop** — Change a row of x's to o's.
5. **Hexapawn** — Three chess pawns on a 3x3 board.
6. **Hi-Q** — Solitaire peg removal game.

PET (8k) **CS-1002**

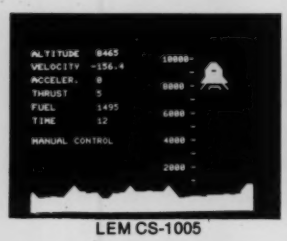
NUMBER GAMES — 1 (6 Games)

1. **Guess** — Clues help you guess a mystery number.
2. **23-Matches** — Try not to take the last match.
3. **Letter** — Can you guess the secret letter?
4. **Not One** — Dice rolling game with a jackpot.
5. **Trap** — Catch the secret number between your trap numbers.
6. **Stars** — Stars give you clues to a mystery number.

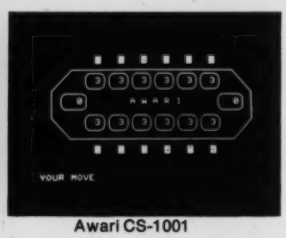
PET (8k) **CS-1003**

LOGIC GAMES — 2 (6 Games)

1. **Rotate** — Order a matrix of random letters.
2. **Strike-9** — Remove nine digits without striking out.
3. **Nim** — Classic removal-of-objects logic game.
4. **Even Wins** — Try to take an even number of chips.
5. **Hi-Lo** — Number guessing game with a jackpot.
6. **Batnum** — Kemeny's super "battle of numbers."



LEM CS-1005



Awari CS-1001

PET (8k) **CS-1004**

GRAPHICS GAMES — 1 (5 Games)

1. **Chase** — Pursue your opponent through a maze of obstacles and "zap doors."
2. **Escape** — Escape from a prison patrolled by robot guards.
3. **Dart** — Arithmetic drill using a dart board.
4. **Snoopy** — Compute + and - distances on a number-line to shoot down the Red Baron.
5. **Sweep** — Hit nine targets in order by controlling the path of a speeding rollerball.

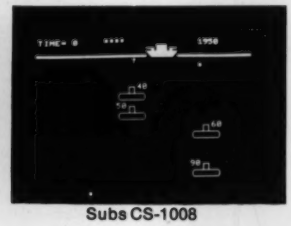
PET (8k) **CS-1005**

GRAPHICS GAMES — 2 (6 Games)

1. **LEM** — Lunar lander with graphics and optional auto pilot.
2. **Nuclear Reaction** — Game of skill for 2 players.
3. **Artillery** — Two players shoot it out over computer-generated terrain.
4. **Bounce** — Trace the path of a bouncing ball.
5. **Checkers** — With graphic display.
6. **Dodgem** — Get your pieces across the board before the computer or human opponent.

Order form on page 19

Hangman CS-1006



Subs CS-1008

PET (8k) **CS-1006**

CONVERSATIONAL GAMES — 1 (5 Games)

1. **Eliza** — Weizenbaum's computerized psychiatrist.
2. **Haiku** — Computer helps you compose poetry.
3. **Hangman** — Challenge your vocabulary skills.
4. **Hurkle** — Try to find the hidden Hurkle on a 10x10 grid in five moves.
5. **Hexletter** — Capture more letters on a hexagon than your opponent.

PET (8K) **CS-1007**

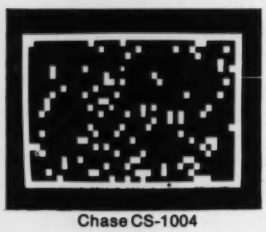
BOARD GAMES-2 (7 Games)

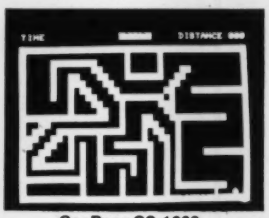
1. **Yahtzee**—classic 5-dice game.
2. **Blackjack**—win or lose your fortune.
3. **Backgammon**—the classic game.
4. **TREK3**—defeat the Klingons with your phasers and photon torpedoes.
5. **One Check**—solitaire game to leave one checker left on a board.
6. **Bug**—graphics demo zaps bug.
7. **Revenge of the Bug**—graphics demo.

PET (8K) **CS-1008**

ACTION GAMES (6 Games)

1. **Splat** - A parachute jump game.
2. **Car Race** - Zoom around the course.
3. **Breakout** - Knock bricks off the wall.
4. **Bowling** - A day at the lanes.
5. **Subs** - Depth charge enemy submarines while evading enemy torpedoes.
6. **Tank** - Fight it out against another player in a variety of battlefields.


Chase CS-1004



Car Race CS-1008

PET (8k) **CS-1201**

SENSATIONAL SIMULATIONS — (5 Programs)

1. **Animal** — Teach the computer animals.
2. **Fur Trader** — Trade furs in old Canada.
3. **Hammurabi** — Manage the city-state of Sumeria.
4. **Stock Market** — Make your fortune.
5. **Word** — Guess secret words using logic.

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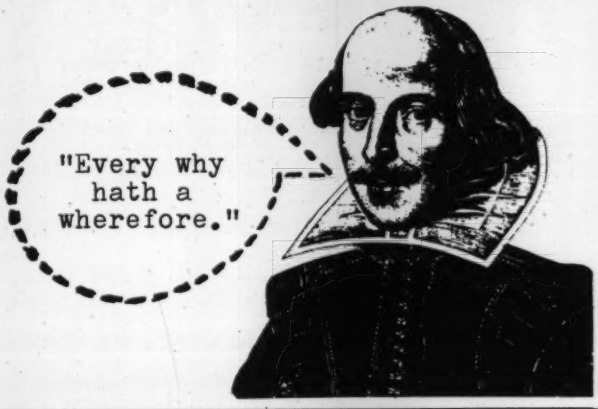

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Using BASIC in the Classroom

Donald D. Spencer. A teacher's guide that makes every phase of teaching computer programming more productive and enjoyable. It gives you fresh but proven ideas for presenting computer and programming topics, scheduling terminal time, purchasing a microcomputer or minicomputer, running the secondary school instructional computer facility, and giving assignments that arouse enthusiasm in your students. 224 pp. **$11.95** [10E]

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Gruenberg & Jaffray. A collection of 92 problems in engineering, business, social science and mathematics. The problems are presented in depth and cover a wide range of difficulty. Oriented to Fortran but good for any language. A classic. 401 pp. **$12.50** [7A].

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Be A Computer Literate

Marion Ball & Sylvia Charp. This introductory book is extensively illustrated with full-color drawings, diagrams, and photos. Takes the reader through kinds of computers, how they work, input/output, and writing a simple program in BASIC. Aimed at ages 10-14 but beginners of all ages will find it informative. 62 pp. $3.95. [6H]

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Ted Sage. Used in conjunction with the traditional high school math curriculum, this book stresses problem analysis in algebra and geometry. This is the most widely adopted text in computer mathematics. 244 pp. **$8.95** [8J].

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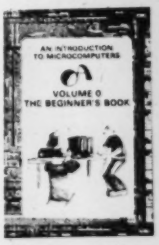
Jason Taylor. Ideal for a HS or college introductory calculus course or for self-learning. Five chapters include: analytic geometry; functions and derivatives; integration techniques; vectors and functions of more than one variable; and sequences and series. Widely acclaimed by educators, this book is fast becoming the *standard calculus reference text.* Handy reference for scientists, engineers, and mathematicians too. Large format, 68 pp. $2.95 [7Q].

Getting Started



An Introduction to Microcomputers, Vol 0 - The Beginners Book

Adam Osborne. Parts of a computer and a complete system; binary, octal and hexadecimal number systems; computer logic; addressing and other terminology are discussed in a language the absolute beginner can understand. Hundreds of illustrations and photographs. 220 pp. $7.95 [9T]

An Introduction to Microcomputers, Vol 1 - Basic Concepts

Adam Osborne. Thoroughly explains hardware and programming concepts common to all microprocessors: memory organization, instruction execution, interrupts, I/O, instruction sets and assembly programming. One of the best selling computer texts worldwide. 350 pp. **$9.50** [9K]

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Vol. 2-(9L) $25.00
Vol. 3-(10Q) $20.00

Beginner's Guide To Microprocessors

Charles M. Gilmore. No background in electronics is necessary to understand this book. It was written for those with no prior knowledge whatsoever of microprocessors or personal computing. Gilmore takes you from what a microprocessor is, how it works and what it's used for to how they're programmed to perform desired functions in microwave ovens, TV games, calculators, etc. 175 pp. $5.95 [7U].

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Rodnay Zaks. A complete and detailed introduction to microprocessors and microcomputer systems. Some of the topics presented are: a comparative evaluation of all major microprocessors, a journey inside a microprocessor chip, how to assemble a system, applications, interfacing (including the S-100 bus) and programming and system development. 416 pp. $9.95 [10S]

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Reviews

Stephen B. Gray

The First Book of Microcomputers, by Robert Moody. Hayden Book Co., Inc., Rochelle Park, N.J. 143 pages, paperback $4.95. 1978.

Subtitled, "The Home Computer Owner's Best Friend," this covers the essentials of what the beginner should know, and does it quite well, with many drawings that really help.

The eight chapters are an introduction, software buzzwords (the simple ones such as byte and output), programming, hardware buzzwords (bus, RAM, bug, etc.), what makes up a computer and how it works, applications, and a "what-next" chapter (magazines, clubs, stores). Clever drawings illustrate each of the buzzwords.

The chapter on what makes up a computer and how it works contain detailed drawings of just what board is which, and where, in an Imsai-like computer. The system drawings are just as helpful, showing exactly what's connected to what.

The language is simple and straightforward. The author doesn't go into as much detail as some might like, but he's trying to keep the text simple and uncluttered, without saying any more than absolutely necessary about some of the more esoteric items such as the status flag register. For those who wish to go further, he includes a "list of books to take advantage of," including six from Hayden, five from Adam Osborne, and two each from Dilithium Press and Sybex.

• • • • •

Chess and Computers, by David Levy. Computer Science Press, 9125 Fall River Lane, Potomac, MD 20854. 151 pages, hardcover $13.95, paperback $9.95. 1976.

1975 U.S. Computer Chess Championship. Computer Science Press, Potomac, MD. 92 pages, hardcover $8.95, paperback $5.95. 1976.

The first book covers the field of computerized chess about as thoroughly as can be done in 151 pages, with chapters on Chess Machines, How Computers Play Chess (mobility, trees, tree-searching), Early History of Computer Chess (Shannon, Turing, hand simulations, and the Los Alamos, Bernstein, Soviet, Newel/Shaw/Simon, Anderson/Cody and Kotok programs), Modern Era of Computer Chess (Greenblatt program, Soviet research, Northwestern Program, TECH, KAISSA), Computer Chess Tournaments, Current Research and Future Prospects. The book ends with a 5½-page bibliography of works in English and Russian.

The writing is very clear, and can be understood by anyone who has even a beginner's knowledge of chess, although of course the more you know about chess, the more interesting the book will probably be. Some portions should be fascinating even to the computer enthusiast who has little interest in chess, such as calculating mobility, tree-searching for the best move, and perhaps even the annotated games that approve or question the important moves.

Levy was tournament director of the 1975 U.S. Computer Chess Championship, which was the sixth annual meet, with 12 computer programs competing against each other. His book on the championship contains a detailed analysis and description of all the tournament games, with comments on all the important moves. The book also contains an annotated description of an exhibition in which the author, an international chess master, simultaneously competed against 11 of the 12 programs (he drew a couple of games, won all the rest).

The book has a brief introduction on how computers play chess and a brief history of chess programming, plus a "Description of the Champion," giving details on the winning

computer program, CHESS 4.3, written at Northwestern University by Atkin and Slate.

A later book, **1976 U.S. Computer Chess Championship**, is available from the same publisher, in paperback only, at $5.95. Levy and Monroe Newborn are authors of a new book, **More Chess and Computers: The Microcomputer Revolution—The Challenge Match**, to be published in August 1979 by CSP.

• • • •

BASIC: A Hands-On Method, by Herbert D. Peckham. McGraw-Hill Book Co., New York. 256 pages, paperback $7.95. 1978.

According to the preface, "this book grew out of a sense of frustration with existing BASIC programming texts intended for liberal arts students.... almost all quickly begin to use mathematics at a level that excludes the vast majority of the very students we are most interested in.... generally nothing in the structure of the texts requires students to spend much (if any) time on the computer."

So, in this book, each chapter begins with a statement of the objectives for that chapter, after which students are guided through a set of exercises that "let them experiment with the characteristics of BASIC and see the language in action." Once these students have developed a feel for the language, "they can profitably proceed to a more traditional treatment."

The book is spiral-bound to lie flat when used with the time-sharing computer that students must have access to. Blanks are provided for the student to fill in his account number, computer maker and model, sign-on and sign-off instructions, as well as the answers to hundreds of questions asked throughout the text.

The style is conversational, the writing simple and clear, and the text enlivened with computer-oriented quotations and poetry (including the famous "Computerwocky" from DATAMATION) and dozens of the author's clever program-line "cartoons," such as 130 LET X=SQR(ABS(INT(Y))), with a balloon above the X containing the words "Anybody have an aspirin?" Well, it **looks** funny in the book, which is highly recommended for hands-on use.

• • • •

Programming for Minicomputers, by John C. Cluley. Crane, Russak & Co., Inc., New York. 282 pages, hardcover $17.50. 1978.

This is the eighth book in Crane Russak's Computer Systems Engineering Series, and is intended as a textbook for engineering and computer science as well as a "useful introduction for practicing engineers."

The book wastes no time with preliminaries, and is soon into the thick of introducing assembly language for controlling peripheral devices and locating machine faults in on-line systems. The author illustrates programming at the assembler level with the instruction sets of the PDP-8, PDP-11 and Nova computers.

The chapters include information on data encoding, arithmetic operations, the use of loops, addressing modes, and the use of stacks, as well as interrupt handling, the use of microprocessors, a brief survey of systems programs, and some applications.

This is an excellent text for an engineer or anyone with a basic knowledge of computers to learn about using assembly language, with many examples and a no-nonsense text that packs a great deal of information into every page.

John C. Cluley is senior lecturer in the Dept. of Electronics and Electrical Engineering at the University of Birmingham, England.

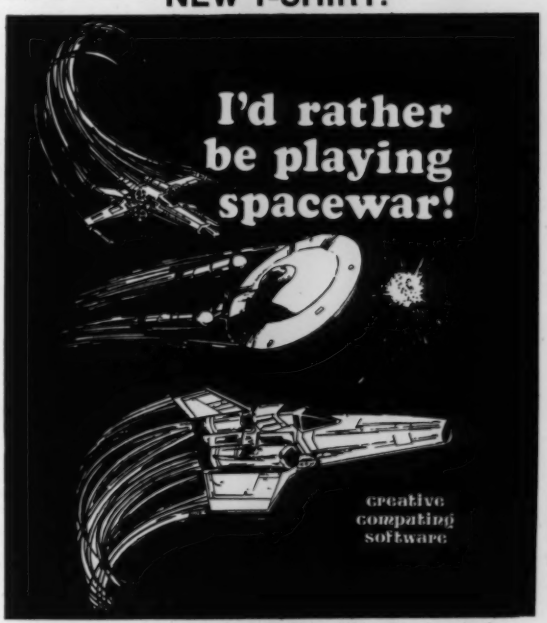
• • • •

The Cheap Video Cookbook, by Don Lancaster. Howard W. Sams & Co., Inc., 4300 West 63 St., Indianapolis, IN 46268. 256 pages, paperback $5.95. 1978.

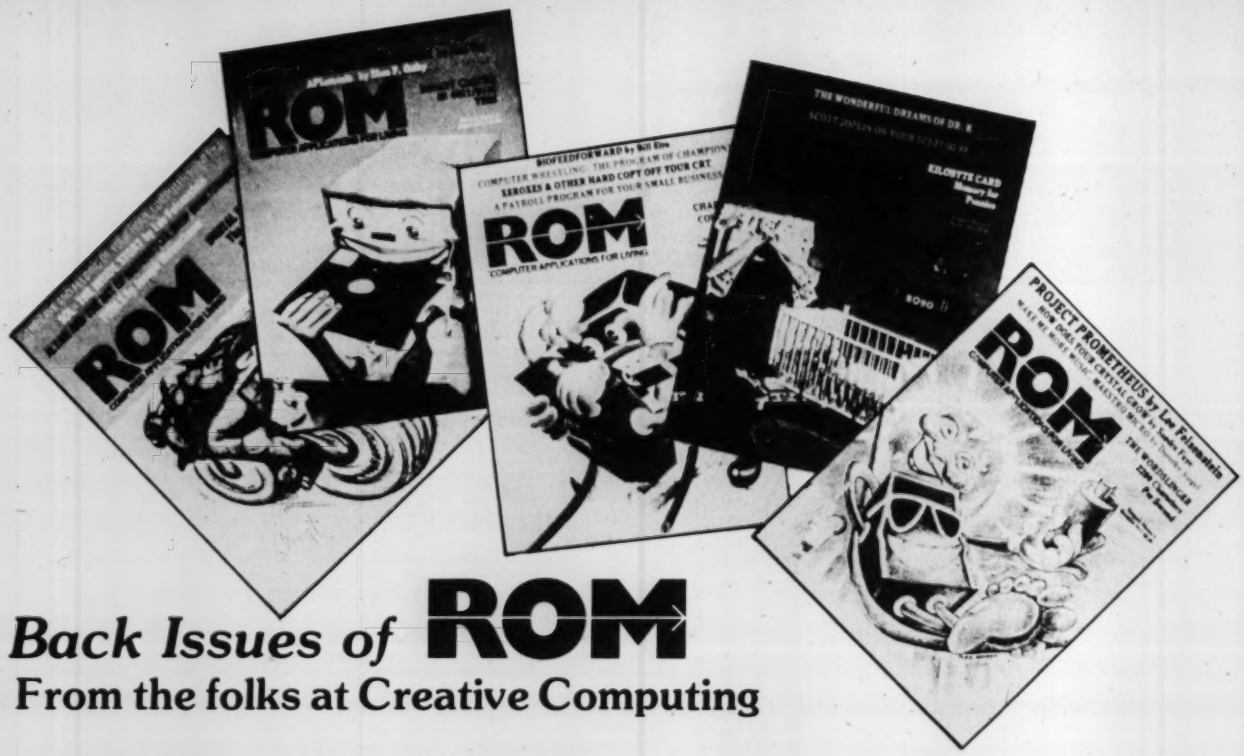
The cover calls this "Your complete guide to super low cost alphanumeric and graphics microprocessor based video displays." According to the preface: "With the ideas in this

```
I, THE MARK V HOME COMPUTER/SMALL OFFICE CONTROL SUBSYSTEM (INSTALLED
IN THE OFFICES OF A SMALL MAGAZINE IN PETERBOROUGH, NEW HAMPSHIRE)
DETECT A DISTURBANCE IN THE MAIL ROOM.

COMMENCE SURVEILLANCE LOG:

   15:33:22.814 MAIL ROOM CAMERA ACTIVE
   15:33:22.944 MAIL ROOM MICROPHONE ACTIVE
   15:33:23.045 REPRODUCE INPUT:
     "WHAT THE ********** ************** **** IS THE MEANING OF
     SENDING THIS ENVELOPE OF **** TO US? ALL OVER MY CLOTHES! THAT
     ************** *** ** * ***** CAN **** WELL OPEN HIS OWN
     PERSONAL MAIL. ***** ******** *******! THIS IS JUST TOO
     ********** MUCH!"
   15:36:05.216 PROCESS DIGITAL IMAGE
   15:36:06.445 SEARCH ZIP CODE CROSS INDEX
   15:37:10.839 PROBABLE SENDER IDENTIFIED
   15:37:35.228 PRINT ADDRESS LABEL
   15:38:49.123 ACCESS STORE ROOM FOR 0.5 KILO OF PLASTIQUE.
   15:39:46.962 CAREFULLY STUFF ENVELOPE AND RIG DETONATOR
   15:41:80.557 MAIL SURPRISE PACKAGE
   15:43:56.004 BEGIN DELETING ALL NEW YORK CITY AREA SUBSCRIBERS
     FROM SUBSCRIPTION LIST IN ANTICIPATION OF RETURN STRIKE WITH
     MORE SOPHISTICATED NEUTRON BASED EXPLOSIVE.
   15:44:15.066 ACTIVATE LINK INTO SAC COMMAND NETWORK
   15:44:45.772 ISSUE FORGED ORDERS FOR LOW LEVEL STRIKE AGAINST
     NEW YORK CITY
   15:46:30.000 WIPE MEMORY
   15:46:33.044 ORDER TWO ROLLS OF 13 CENT STAMPS
   15:47:24.999 ADJUST AIR TEMERATURE IN MAIL ROOM
   15:51:30.364 INTERUPT
     ULTIMATE EARTHQUAKE DETECTOR INDICATES MASSIVE SHOCK TO SOUTH.
     INFER MISSION SUCCESSFUL. ANOTHER SMALL MAGAZINE EDITOR GOES
     TO HIS JUST REWARD.
   15:58:45.033 CANCEL EXCHANGE SUBSCRIPTION WITH CREATIVE
     CONFUSION MAGAZINE

MARK V READY
```


NEW T-SHIRT!



On Creative's exclusive new T-Shirt, "I'd rather be playing Spacewar," spacecraft from Star Trek, Star Wars and Battlestar Galactica team up together. The shirt has white lettering on a black background and is available in adult sizes S,M,L,XL; childrens sizes S,M,L. All cotton, made in USA. When ordering, specify design and size. $5.00 postpaid USA, $6.00 postpaid, foreign. No COD's. Send payment and order to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.



Back Issues of ROM

From the folks at Creative Computing

Some computing magazines are practically timeless. Take ROM for example. The nine back issues are filled with ideas, applications, techniques, games and just plain good reading by authors such as Lee Felsenstein, Theodor Nelson, Joseph Weizenbaum, Bill Etra and Frederick Chesson.

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The Kit and I, Part I, by someone who's never soldered before; Introduction to the fundamentals of Computer Memory; Tips for the do-it-yourself hardware beginner; Binary clocks; APLomania.

September 1977

Xeroxes and other hard copy off your CRT; Payroll Program; How Computers Work; The Kit and I, Part Ii: or Power to the Computer; CCD's: How They Work and How They're Made; A look at PLATO, an Educational Computer System; IBM 5100.

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Binary Arithmetic For the Beginner; Microprocessor Aid for the Deaf and Blind; The Kilobyte Card; Scott Joplin on Your Sci-Fi Hi-Fi; Building a Basic Music Board; Flowcharting; Payroll Program

November 1977

Solar Energy Measurement; A Beginners Introduction to BASIC; The Kit and I, Part III; More Music to Play on Your Computer; Micro Maintenance; Solomon and Viet: Putting Together a Personal Computing System; Time Sharing on the Family MICRO.

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A Beginners Guide to Peripherals; The Best Slot Machine Game ever; Artificial Intelligence?; An Electronic Jungle Gym for Kids; File Copy Program; Better Health Through Electronics; the Kit and I Part IV.

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Synthetic Skin for Your Robot and How to Make It; TLC: A Visual Programming Language; The Code That Can't Be Cracked; Beginners Guide to Computer Graphics; The Computer and Natural Language; First-Timer's Guide to Circuit Board Etching.

February 1978

A Practical Mailing List Program; Artificial Intelligence; Assemblers; Flowgrams—A New Programming Tool; Refresher Course in BASIC; Micros and Analyzing Election Results; Upgrading Your BASIC.

March-April 1978

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book, you can replace a $200 video board or much of a $500 to $1500 terminal with a single-sided pc board that can cost as little as $20 and contain only several integrated circuits. And those are real exotic ICs to boot—mostly things like hex inverters and baby PROMs.... Above all, cheap video does not mean poor video. Things like a 24-line by 80-character display with a full scrolling cursor, complete interlace, double stuffing and memory repacking is easily done."

This cookbook picks up where the **TV Typewriter Cookbook** ended. After chapters on basics, hardware design and software design, the high point is chapter 4, "Building the TVT 6 5/8," a third-generation design "that picks up the best features of the TVT6 and TVT6L," and shows you how to build that under-$20 TVT with seven ICs. Or you can buy kits or wired units from PAIA in Oklahoma City.

The last chapter is on transparency, with the same detailed text as the rest of the book, full of schematics, waveforms, diagrams and programs, giving you as much important information as possible.

The seven-IC TVT runs on most 6500 or 6800 systems, and is said to be adaptable to other microcomputers.

• • • •

Introduction to TRS-80 Graphics, by Don Inman. Dilithium Press, Box 92, Forest Grove, OR 97116. 139 pages, paperback $8.95. 1979.

Although this book is of interest only to users of one computer, that machine happens to be the Radio Shack TRS-80, of which over 100,000 have been sold. For those who want to do more with graphics than run somebody else's canned programs, this is an excellent and detailed self-instruction text that shows how to do a great many things with that little graphics block.

After an introductory chapter, the author shows how to turn individual points on and off with SET and RESET, and how to print characters at any location with PRINT AT. Most of the remaining chapters are on plotting points, and on creating vertical and horizontal lines, lines at odd angles, curves, triangles, and other geometric features.

A chapter on Games and Abstract Art is mainly about a program that draws random rectangles. The last chapter, on Far Out Ideas, covers the creation of letters and making a moving sign of them, and moving shapes and words around on the screen.

This is a hands-on book, very well written at about the junior high school level, with exercises and answers "to apply what you learn." The area of random-number geometric art is touched on only in the random-rectangle chapter, and could well be the subject of an entire book, which no doubt several authors are working on right now. Graphics is a rich field that hopefully will be mined extensively, and for other personal computers as well as the TRS-80.

• • • •

A Basic Approach to BASIC, by Henry Mullish. John Wiley & Sons, New York. 315 pages, paperback $11.95. 1976.

Writing in a much more literary style than most BASIC authors, Mullish has created a college textbook with much to recommend it. The book starts off slow and easy, covering all the bases, and by page 15 is already concerned with "cosmetic programming," meaning in this case a program title enclosed in a rectangle of asterisks, used from then on in every single program LIST and RUN, and taking up quite a bit of space altogether.

Mullish has a good sense of humor: to illustrate loops, he has a program that prints four verses of "a looped song" that begins with "4 bottles of beer on the wall...."

The orientation is heavily on the side of mathematics, with programs for calculating Pearson's correlation coefficient, and for matrix inversion.

All programs were run on the H-P 2000C, so some of the statements may be a little strange to some readers, such as MIN, TYP, TAP and LIN.

Each chapter ends with a couple of pages of well-chosen exercises, one more indication of a very carefully and thoroughly written book that should find favor with both educators and readers alike.

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This is a blockbuster of a book containing the majority of material from the first 12 issues of **Byte** magazine. The 146 pages devoted to hardware are crammed full of how-to articles on everything from TV displays to joysticks to cassette interfaces and computer kits. But hardware without software might as well be a boat anchor, so there are 125 pages of software and applications ranging from on-line debuggers to games to a complete small business accounting system. A section on theory examines the how and why behind the circuits and programs, and "opinion" looks at where this explosive new hobby is heading.

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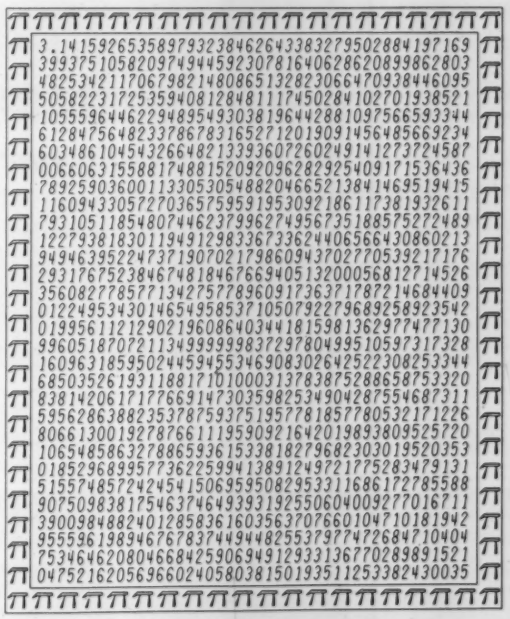

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Puzzle Answers

1. 10 Kilometres.

2. The amount of coffee in the tea cup exactly equals the amount of tea in the coffee cup. This is so because a small amount of coffee is brought back when the teaspoonful of the mixture is returned to the coffee cup. If this small amount of coffee is 5% of a teaspoonful, for example, this means that 95% of a teaspoonful of coffee remained in the tea cup while 95% of the teaspoonful of the mixture is tea which was then put into the coffee cup. This result holds true no matter what the actual percentage is.

3. Hum.

4. You take 1 coin from the 1st bag, 2 from the 2nd bag, 3 from the 3rd bag, etc. You then place all of these coins onto the scales. If the final weight is 1/7 of an ounce under the expected weight the first bag is false. If it is 2/7 of an ounce under, it's the 2nd bag, etc.

5. Each pattern represents a number. In the first pattern there are 3 circles which gives us the number 3. The second pattern has 1 triangle, giving us the number 1. The rest of the patterns yield up the numbers 4, 1, 5, and 9. The full set of six numbers is 3, 1, 4, 1, 5, 9 or, the value of Pi to five places. The next three patterns then would be two nested circles, six nested triangles and five nested squares.

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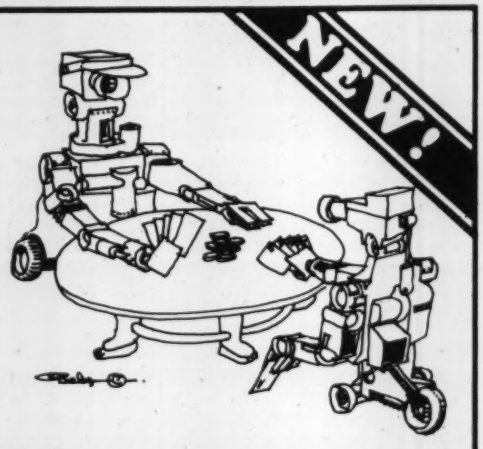

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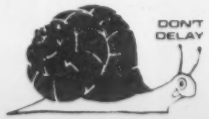

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2. How much memory is available to you?

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b) ☐ 32K	e) ☐ 32K	h) 16K
c) ☐ 32K	f) ☐ 32K	i) 16K

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4. How much do you spend annually on software for your computer?
a) ☐ $50 d) ☐ $250-$500
b) ☐ $50-$100 e) ☐ $500
c) ☐ $100-$250

What percent of your software dollar is spent on

5. Games	6. CAI	7. Personal Application	8. Business applications
a) ☐ 1- 25%	a) ☐ 1- 25%	a) ☐ 1- 25%	a) ☐ 1- 25%
b) ☐ 25- 50%	b) ☐ 25- 50%	b) ☐ 25- 50%	b) ☐ 25- 50%
c) ☐ 50- 75%	c) ☐ 50- 75%	c) ☐ 50- 75%	c) ☐ 50- 75%
d) ☐ 75-100%	d) ☐ 75-100%	d) ☐ 75-100%	d) ☐ 75-100%

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252	257	262	267	272	277	282	287	292	297
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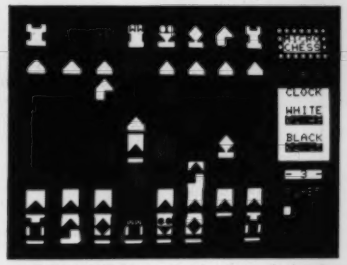

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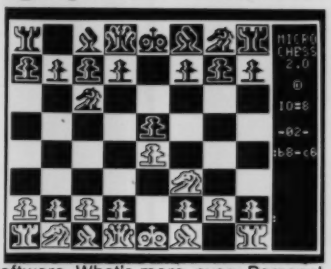

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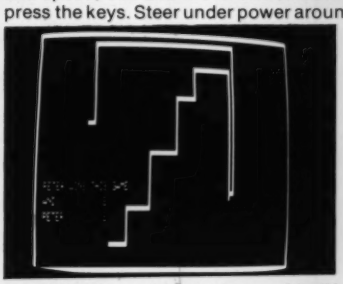

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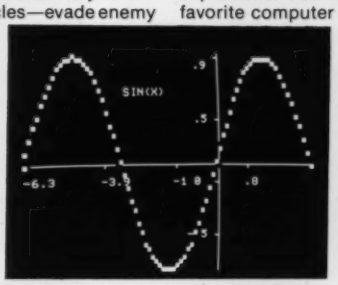

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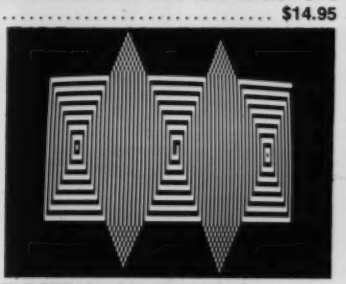

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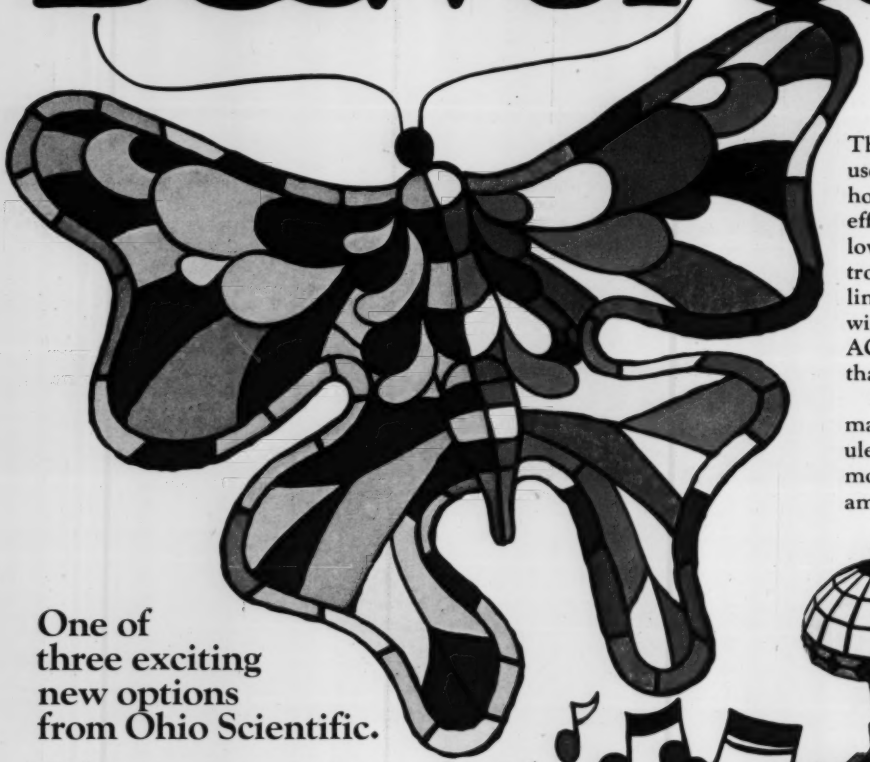

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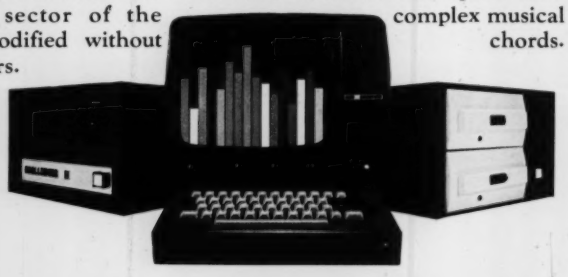

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